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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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INTRODUCTION

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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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02 Aircraft 736
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

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05 Biotechnology 750
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06 Chemistry 752
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

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Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 817
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

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28 Propulsion Systems 835
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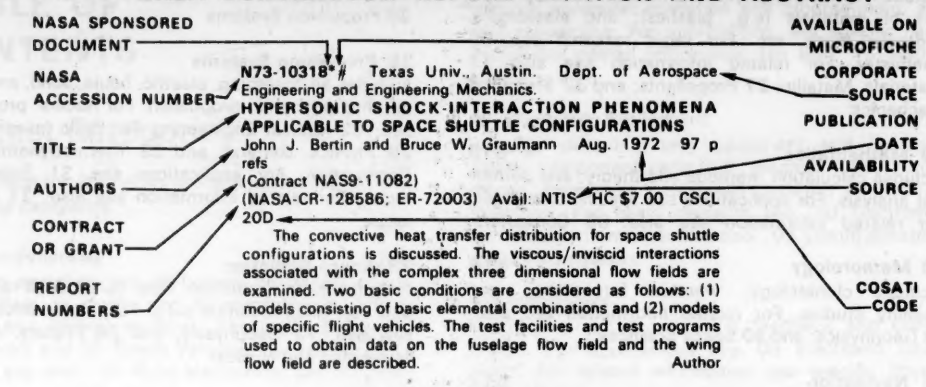
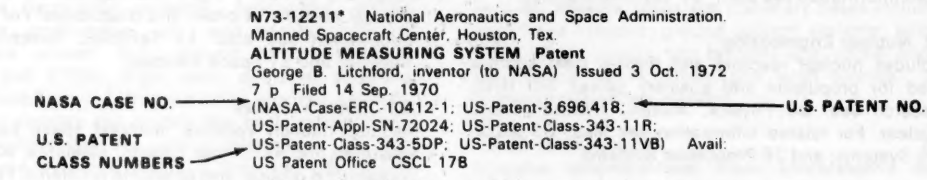


N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D

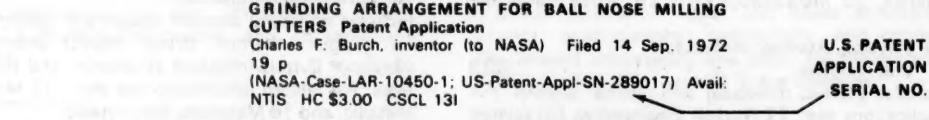
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

PATENT CITATION



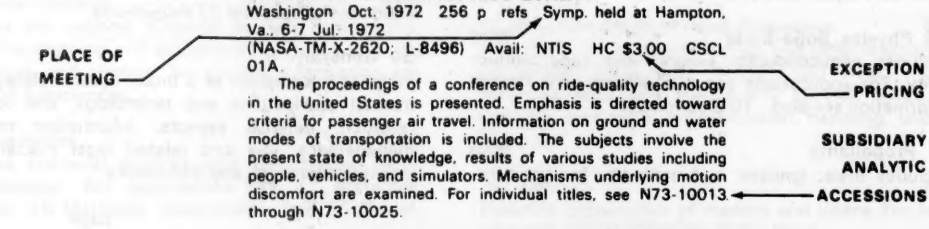
N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION



N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRARNGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT



N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A.

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02) CSCL 01A

Volume 11 Number 7 / April 8, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-15978 Engineering Sciences Data Unit, London (England).
INFORMATION ON THE USE OF DATA ITEMS ON ROLLING MOMENT DERIVATIVES OF AN AEROPLANE
1972 2 p
(ESDU-Aircraft-06.01.00) Avail: Issuing Activity

Rolling moment derivatives of an aircraft due to rolling, yawing, and sideslip are discussed. The rolling moments are due to asymmetrical changes in the air flow over the aircraft and the consequent changes in pressure distribution. Procedure is based on principle of calculating effects of various components of the aircraft separately and adding the part derivatives to obtain the overall effect. Author

N73-15979 Engineering Sciences Data Unit, London (England).
INFORMATION ON THE USE OF DATA ITEMS IN THE SERIES BODIES 02.04
1971 3 p ref
(ESDU-Bodies-02.04.00) Copyright. Avail: Issuing Activity

An explanation of the calculation of drag for streamline bodies at small angles of incidence is presented along with the curves for determining body drag coefficients behind nose cones. F.O.S.

N73-15980 Engineering Sciences Data Unit, London (England).
EFFECT OF WING ON ROLLING MOVEMENT DUE TO YAWING
Sep. 1972 19 p refs Supersedes ESDU-Aero-A.06.01.02.and ESDU-Aero-A.06.01.08 Sponsored by Roy. Aeron. Soc.
(ESDU-72021; ESDU-Aero-A.06.01.02; ESDU-Aero-A.06.01.08) Copyright. Avail: Issuing Activity CSCL 01A

A method for estimating the contribution of a straight tapered swept wing to the rolling moment derivative due to yawing at lift coefficients for which the flow remains fully attached is presented. The flow is assumed to be subsonic over the whole wing. The basic planform contribution and the effects of dihedral, twist, and deflected trailing edge flaps are considered. Mathematical models are included to amplify the text. Author

N73-15981 Engineering Sciences Data Unit, London (England).
AERODYNAMIC CHARACTERISTICS OF AEROFOILS IN COMPRESSIBLE INVISCID AIRFLOW AT SUBCRITICAL MACH NUMBERS
Oct. 1972 25 p refs Sponsored by Roy. Aeron. Soc.
(ESDU-72024) Copyright. Avail: Issuing Activity CSCL 01A

A method for estimating a number of aerodynamic characteristics of any given airfoil in compressible inviscid airflow from a knowledge only of the thickness and camber line parameters is presented. The aerodynamic characteristics considered are: (1) lift-curve slope at zero lift, (2) zero-lift incidence, (3) zero-lift pitching moment coefficient, and (4) chordwise position of the aerodynamic center. The geometrical parameters required to obtain estimates for the aerodynamic characteristics are tabulated. Author

N73-15982 Engineering Sciences Data Unit, London (England).
COMPARISONS WITH EXPERIMENTAL DATA
Sep. 1972 5 p refs
(ESDU-70011-Amend-A) Copyright. Avail: Issuing Activity

The development of aerodynamic coefficients for wings of small thickness in inviscid flow is discussed. The errors introduced by neglecting the effects of thickness and viscosity in determining the lift-curve slope and aerodynamic center position are analyzed. The analysis is limited to wings at low incidence for Mach numbers up to 0.6. The data are presented as tables and graphs. Author

N73-15983 Pennsylvania Univ., Philadelphia.
UNSTEADY AIRFOIL THEORY APPLIED TO CAMBERED BLADES AND TO BLADE ROWS OF HIGH SOLIDITY Ph.D. Thesis
Helmut G. W. Naumann 1971 132 p
Avail: Univ. Microfilms Order No. 72-17403

In turbomachinery as rotor blades pass through the wakes of upstream stator blades each blade experiences pressure and lift fluctuations. The first problem discussed deals with the pressure and lift fluctuations of low solidity cascades where the mutual induction effect of blades of the same blade row becomes negligible. The second problem deals with high solidity cascades. Dissert. Abstr.

N73-15984*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 23, OCTOBER 1972
Oct. 1972 112 p refs
(NASA-SP-7037(23)) Avail: NTIS HC $3.00 CSCL 01A

This special bibliography lists 378 reports, articles, and other documents introduced into the NASA scientific and technical information system in September, 1972. Author

N73-15985*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUPERSONIC AERODYNAMIC CHARACTERISTICS OF A VARIABLE-GEOMETRY SPACECRAFT DESIGNED FOR HIGH HYPERSONIC PERFORMANCE
Bernard Spencer, Jr. and Roger H. Fournier Washington Jan. 1973 48 p refs
(NASA-TM-X-2703; L-8639) Avail: NTIS HC $3.00 CSCL 01A

An investigation was made in the high Mach number test section of the Langley Unitary Plan wind tunnel on a variable-geometry high hypersonic performance spacecraft concept at Mach numbers from 2.30 to 4.63. The basic lifting body is designed for hypersonic lift-drag ratio near 3.0. The variable-geometry feature is a single-pivot two-position high wing which is deployed at subsonic speeds to improve vehicle landing characteristics.

For the present investigation the wing was maintained in a stowed position, and the effects of horizontal stabilizer dihedral, elevon control effectiveness, and the addition of either a conventional single vertical tail or dorsal-fin-type vertical stabilizers on the longitudinal and lateral-directional stability and control characteristics were studied. Author

N73-15986*# Washington Univ., Seattle.
A TWO-DIMENSIONAL, ITERATIVE SOLUTION FOR THE JET FLAP
Alan Charles Herold Washington NASA Feb. 1973 48 p refs
(Grant NGL-48-002-010)
(NASA-CR-2190) Avail: NTIS HC $3.00 CSCL 01A

A solution is presented for the jet-flapped wing in two dimensions. The main flow is assumed to be inviscid and incompressible. The flow inside the jet is considered irrotational and the upper and lower boundaries between the jet and free stream are assumed to behave as vortex sheets which allow no mixing. The solution is found to be in satisfactory agreement with two dimensional experimental results and other theoretical work for intermediate values of momentum coefficient, but the regions of agreement vary with jet exit angle. At small values of momentum coefficient, the trajectory for the jet, as computed by this method, has more penetration than that of other available data, while at high values of moment coefficient this solution results in less penetration of the jet into the main flow. Author

N73-15987*# National Aeronautics and Space Administration, Washington, D.C.
ON PEAKY AIRFOIL SECTIONS
Junzo Sato Feb. 1973 43 p refs Transl. into ENGLISH from J. Jap. Soc. Aeronaut. Space Sci. (Japan), v. 18, no. 201, Oct. 1970 p 374-388
(NASA-TT-F-749) Avail: NTIS HC $3.00 CSCL 01A

The development of airfoil configurations to provide shock-free flow at supersonic speeds is discussed. The airfoil design creates local supersonic regions on the surfaces of the airfoil sections. Expansion waves reflected at sonic lines come back to the airfoil surface as compression waves which decelerate the local supersonic flow isentropically to subsonic speeds. A characteristic of the airfoil section is that a negative pressure peak exists close to the leading edge. Schlieren photographs of the shock wave patterns on typical airfoil sections are provided. Graphs of the pressure distribution for various airfoil configurations and conditions of flight are included. P.N.F.

N73-15988*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC CHARACTERISTICS OF A TWIN-JET SWEPT-WING FIGHTER MODEL WITH MANEUVERING DEVICES
Edward J. Ray and Eddie G. Hollingsworth (McDonnell Douglas Co., St. Louis, Mo.) Washington Jan. 1973 292 p refs
(NASA-TN-D-6921; L-8221) Avail: NTIS HC $3.00 CSCL 01A

An investigation has been conducted at Mach numbers ranging from 0.06 to 0.94 to determine the effects of various combinations of leading-edge slat devices on the static aerodynamic characteristics of a twin-jet swept-wing fighter model. The study also included a determination of the effects of wing leading-edge droop, trailing-edge chord-extensions, wing fences, and wing-planform and camber modifications. The angle-of-attack range generally extended from about minus 2 deg to 24 deg and the sideslip angles ranged from about minus 6 deg to 13 deg. Author

N73-15989# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
ANOMALOUS EFFECTS OF PRESSURE GRADIENT ON SUPERSONIC TURBULENT BOUNDARY LAYERS
P. Bradshaw Nov. 1972 22 p refs
(Contract MIN-DEF/PE-AT/2037/102)
(IC-Aero-72-21) Avail: NTIS HC $3.25

Consistent discrepancies between calculations and experiments on supersonic boundary layers in moderate to strong pressure gradients are considered. It is thought that these are due to unexpected, large effects of mean dilation on the Reynolds stresses. Agreement between calculation and experiment is greatly improved by representing the effects of mean dilation in the same way as that used to represent the effects of extra rates of strain in low-speed flows. (ESRO)

N73-15990# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Aachen (West Germany). Inst. fuer Theoretische Gasdynamik.
THE INTERACTION OF INCIDENT SHOCK WAVES WITH PLANE BLUNT BODY FLOW [DER EINFLUSS EINFALLENDER STOSSWELLEN AUF EBENE UEBERSCHALLSTROEMUNGEN UM STUMPFE KOERPER]
Dietrich Rues Jun. 1972 67 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-68) Avail: NTIS HC $5.50; DFVLR Porz-Wahn: 19,40 DM

The interaction of an unsteady incident shock wave with supersonic plane blunt body flow is calculated by a time dependent second order difference method, and applied to the flow around a circular cylinder and a parabolic body. The velocity of the undisturbed flow is M = -4, whereas the velocity of the unsteady incident shock wave is V = -5.5. With these values, the velocity directly behind the incident shock wave is -4.69, for a pressure ratio of 2.46. A strong unsteady pressure increase is found at the stagnation point. The unsteady influence on the flow decreases rapidly after the first reflection of the incident wave by the body. Author (ESRO)

N73-15991# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.
THE EFFECT OF INJECTION ON BASE DRAG AT TRANSONIC SPEED
Renzo Piva and Carlos Dejesus Jul. 1972 59 p refs
(Grant AF-AFOSR-2167-72; AF Proj. 9782)
(AD-751269; NYU-AA-72-19; AFOSR-72-2044TR) Avail: NTIS CSCL 01/1

The problem concerning the possible reduction of the transonic drag for a high speed airplane has been studied. Attention has been focused on decreasing the drag forces on the aft portion of the vehicle. The effect of the injection of a small amount of air in the rear of the model has been experimentally investigated. The alteration of the transonic flow field in the shock-boundary layer interaction region, increases the average pressure on the aft section. The required amount of air was relatively low, because of the high sensitivity of the interaction region to any small change in the flow regime. GRA

N73-15992# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
CIRCULATION CONTROL BY STEADY AND PULSED BLOWING FOR A CAMBERED ELLIPTICAL AIRFOIL
Richard E. Walters, Danny P. Myer, and Daniel J. Holt Jul. 1972 116 p refs
(Contract N00014-68-A-0512; NR Proj. 215-163)
(AD-751045; TR-32) Avail: NTIS CSCL 01/3

An experimental investigation was performed on the effectiveness of circulation control in producing additional lift and preventing separation on a cambered elliptical airfoil section with a rounded trailing edge. Steady blowing and pulsed blowing from a slot near the rear of the airfoil were used for circulation control. Downwash studies were conducted for the airfoil using potential flow theory, and Reynolds number effects were studied for the no blowing case. Airfoil surface-pressure distributions are presented for the various test conditions. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-15993 Engineering Sciences Data Unit, London (England).
LOW SPEED LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF AIRCRAFT IN GROUND EFFECT
Oct. 1972 21 p refs Supersedes ESDU-Aero-A.01.01.01 Sponsored by Roy. Aeron. Soc.
(ESDU-72023; ESDU-Aero-A.01.01.01) Copyright. Avail: Issuing Activity CSCL 01B

A method for estimating the changes in the lift curve, drag, tail lift, and downwash from the wing of an aircraft due to ground effect in incompressible flow is presented. Static treatment of the aerodynamics of aircraft flying in ground effect is defined. The changes in the free air conditions on approaching the ground at constant aircraft lift coefficient by changing incidence are examined. Author

N73-15994 Stanford Univ., Calif.
COMPUTATIONAL METHODS FOR THE SYNTHESIS OF ROTARY WING VTOL AIRCRAFT CONTROL SYSTEMS Ph.D. Thesis
Wilton Earl Hall 1971 257 p
Avail: Univ. Microfilms Order No. 72-11564

A design procedure is developed which models a rotary-wing VTOL aircraft as two coupled rigid bodies which represent the rotor and fuselage respectively. Previous design approaches for the synthesis of VTOL aircraft controllers have treated rotor and fuselage as dynamically uncoupled systems, and generally the rotor dynamics have been neglected in synthesizing the fuselage controls. Only the low-speed flight regime around hover is considered for this design. The equations for the rotor dynamics and rotor forces on the fuselage are obtained from an analysis of blade motions. The controls-fixed dynamic response of the two rigid body approximation is determined for a typical vehicle with an articulated rotor and also with a hingeless rotor. A controller has been designed for the two rigid body approximation using eigenvector decomposition of the Euler-Lagrange equations of quadratic synthesis. Dissert. Abstr.

N73-15995 Duke Univ., Durham, N.C.
DYNAMIC INTERACTIONS OF HIGH SPEED TRACKED AIR CUSHION VEHICLES WITH THEIR GUIDEWAYS: A PARAMETRIC STUDY Ph.D. Thesis
Sherrill Bost Biggers, Jr. 1971 142 p
Avail: Univ. Microfilms Order No. 72-11066

A mathematical model of a tracked air cushion vehicle and its guideway is formulated in order to investigate the vertical dynamic response of the vehicle-guideway system due to high speed vehicle passage. The vehicle is modeled as an arbitrary number of mass systems traveling in tandem, each system consisting of a lower mass (air cushion housing and chassis) and an upper mass (passengers and isolated passenger compartment). A train of vehicles can be represented by using a large number of mass systems in tandem. The vehicle load is transmitted to the guideway as a uniform, distributed pressure which varies in magnitude according to the vehicle vertical accelerations. The guideway is modeled as a series of simply supported Bernoulli-Euler beams with provisions for an elastic subgrade, combined structural and external damping, and a uniform axial compressive force. Dissert. Abstr.

N73-15996 North Carolina State Univ., Raleigh.
DESIGN FOR IMPROVEMENTS TO STATIC PERFORMANCE AND LATERAL-DIRECTIONAL DYNAMIC STABILITY OF A CONSTANT ATTITUDE LIGHT AIRCRAFT Ph.D. Thesis
Douglas Eugene Humphreys 1971 108 p
Avail: Univ. Microfilms Order No. 72-8939

A design study was conducted to improve static performance and lateral-directional dynamic stability for a light aircraft. Design modifications are developed for a PA28-235C Piper Cherokee to enable it to fly at constant pitch attitude during all modes of flight. Lift modulation over the flight profile is accomplished through the use of full-span Fowler flaps. Lateral control is also provided by these full-span flaps. Improvements in static performance are accomplished by reducing the wing area by 25 percent and making greater utilization of propeller performance. The lateral-directional dynamic stability is improved by the design of a stability augmentation system. This system utilizes sideslip and bank angle feedback. Fast acting servos and electrical compensator networks are used to provide rapid bank angle response and to eliminate unwanted disturbances from sidegusts. Dissert. Abstr.

N73-15997 Case Western Reserve Univ., Cleveland, Ohio.
AN OPTIMAL CONFIGURATION DESIGN OF LIFTING SURFACE TYPE STRUCTURES UNDER DYNAMIC CONSTRAINTS Ph.D. Thesis
Hirokazu Miura 1972 222 p
Avail: Univ. Microfilms Order No. 72-18717

An optimization, intended to be used in the preliminary design stage, of the structural configuration for a simplified model of a supersonic airplane wing is undertaken. The simplified plan view shape, the wing depth distribution and the skin panel thickness distribution are determined so that an objective function composed of a linear combination of the weight of the wing and the aerodynamic drag is minimized. In addition to static constraints, (yield stress, displacement, angle of attack and the required gross lift), natural vibration frequency and supersonic flutter speed are considered as constraints. A wing is considered to be a sandwich plate of variable thickness. By smearing all inhomogeneities, the skin panels and the sandwiched core are considered to be orthotropic, homogeneous materials. Distinctly large masses such as engines are considered to be concentrated masses at specified points. Dissert. Abstr.

N73-15998*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SOME EFFECTS OF BIAS ERRORS IN REDUNDANT FLIGHT CONTROL SYSTEMS
Robert F. Stengel Jun. 1972 12 p refs
(Contract NAS9-10268)
(NASA-CR-130354; E-2688) Avail: NTIS HC $3.00 CSCL 01B

The controllability and steady-state response of parallel-redundant flight control systems are examined. It is found that state components which appear in the parallel signal paths, or individual actuator commands, are not controllable, although the sum of the command signals is well-behaved. If the response modes associated with these components are not stable, bias errors can cause the components to diverge, leading to the possibility of nuisance trips in failure detection/isolation logic and eventual control system lockup (at saturation). Combining the inputs to the control computers assures that sensor bias will not cause divergence, while cross-strapping control strings bounds divergent response to all bias error inputs. Results of numerical solutions confirm the problem and its solutions. Author

N73-15999# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: CAPITOL INTERNATIONAL AIRWAYS, INCORPORATED, DC-8-63F, N4909C; ANCHORAGE, ALASKA, 27 NOVEMBER 1970
29 Mar. 1972 48 p
(NTSB-AAR-72-12) Avail: NTIS HC $4.50

A Douglas DC-8-63F aircraft crashed following an unsuccessful takeoff attempt from the Anchorage International Airport Anchorage, Alaska, on 27 Nov. 1970. The flight was being operated as a Military Airlift Command (MAC) contract flight from McChord Air Force Base, Tacoma, Washington, to Cam Ranh Bay, Republic of South Viet Nam, with en route fueling stops at Anchorage, Alaska, and Yokota Air Base, Japan. There were 219 military passengers and a crew of 10 aboard the aircraft. Forty-six passengers and one flight attendant received fatal injuries in the post-crash fire. At the time of the takeoff, precipitation, in the form of freezing drizzle, was occurring at the airport and the runway was covered with a light coating of ice. Evidence of tire skid marks, degraded rubber and shredded tire casings were found over most of the length of the runway. The probable cause of this accident was the failure of the aircraft to attain the necessary airspeed to effect liftoff during the attempted takeoff. Author

N73-16000# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT INCIDENT REPORT: EASTERN AIR LINES, INCORPORATED, BOEING 727-100, N8168G FLIGHT 9701,

ATLANTA, GEORGIA, 21 DECEMBER 1971
26 Jul. 1972 18 p ref
(NTSB-AAR-72-22) Avail: NTIS HC $3.00

A Boeing 727 aircraft struck portions of the approach light system during landing approach at Atlanta International Airport, Georgia on 21 December 1971. Minor damage occurred to the aircraft flaps and landing gear. The cause of the accident was stated as an unexpected and undetected divergence of the aircraft from the glide slope centerline induced by a malfunction of the automatic pilot. The divergence occured at an altitude where safe recovery could have been made, however, the preoccupation of the pilots with establishing an outside visual reference precluded timely recognition of the divergence. Author

N73-16001# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AVIATION. ISSUE NO. 3: 1971 ACCIDENTS
29 Sep. 1972 485 p
(NTSB-BA-72-6) Avail: NTIS HC $26.25

Selected aircraft accident reports, in brief format, occurring in U.S. Civil Aviation operations during calendar year 1971 are presented. The 900 General Aviation accidents contained in this publication represent a random selection. This publication is issued irregularly, normally six times each year. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N73-16002# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AVIATION. ISSUE NO. 4: 1971 ACCIDENTS
4 Dec. 1972 512 p
(NTSB-BA-72-7) Avail: NTIS HC $27.75

Selected aircraft accident reports, in brief format, occurring in U.S. Civil Aviation operations during calendar year 1971 are presented. The General Aviation accidents contained in this publication represent a random selection. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N73-16003# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: ROSS AVIATION, INCORPORATED, BEECHCRAFT 65-B80, QUEEN AIR, N841NS, ALBUQUERQUE, NEW MEXICO, 19 MAY 1972
13 Dec. 1972 19 p
(NTSB-AAR-72-32) Avail: NTIS HC $3.00

A Beechcraft Queen Air aircraft, on a scheduled air taxi flight, crashed shortly after takeoff at the Albuquerque, New Mexico airport on 19 May 1972. The aircraft was destroyed by impact forces and post-impact fire. The probable cause of the accident was inadvertent opening of the forward cargo compartment door with resulting damage to the left propeller. Loss of power from the left engine at a critical stage of flight caused the aircraft to crash. Author

N73-16004# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: PUERTO RICO INTERNATIONAL AIRLINES (PRINAIR), INCORPORATED, DEHAVILLAND DH-114, N554PR, PONCE, PUERTO RICO, 24 JUNE 1972
20 Dec. 1972 13 p
(NTSB-AAR-72-34) Avail: NTIS HC $3.00

A DeHavilland Heron DH-114 crashed on the Mercedita Airport, Ponce, Puerto Rico, during an attempted go-around after landing on Runway 29, on 24 June 1972. The probable cause of this accident was the presence of an unauthorized vehicle on the runway which caused the pilot to attempt a go-around after touchdown to avoid a collision. The maneuver resulted in an overrotation of the aircraft at too low an airspeed to sustain flight. Author

N73-16005# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: EASTERN AIRLINES, INCORPORATED, DC-9-31, N8961E, FORT LAUDERDALE, FLORIDA, 18 MAY 1972
13 Dec. 1972 36 p
(NTSB-AAR-72-31) Avail: NTIS HC $4.00

A DC-9 aircraft was involved in a landing accident on May 18, 1972, at approximately 1521 eastern daylight time, at the Fort Lauderdale-Hollywood International Airport, Fort Lauderdale, Florida. The accident occurred following a straight-in localizer approach when the aircraft touched down hard on the runway, resulting in the failure of the main landing gear and the separation of the tail section from the aircraft. The aircraft was destroyed by subsequent ground fire. At the time of the accident, heavy rainshowers, associated with thunderstorm activity, were occurring at the airport. The probable cause of this accident was the decision of the pilot to initiate and continue an instrument approach under weather conditions which precluded adequate visual reference and the faulty techniques used by the pilot during the landing phase of that approach. The flightcrew's nonadherence to prescribed operational practices and procedures compromised the safe operation of the flight. Author

N73-16006# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: AERO TAXI, BEECH E18S, N42A, CLEVELAND, OHIO, 22 JUNE 1972
20 Dec. 1972 24 p
(NTSB-AAR-72-33) Avail: NTIS HC $3.25

A Beech Aircraft, Model E18S, on an air taxi revenue cargo flight, crashed into a residential area at approximately 0840 eastern daylight time, June 22, 1972. The accident occurred shortly after takeoff from Cleveland-Hopkins International Airport, Cleveland, Ohio. The pilot, the only occupant of the aircraft, was fatally injured. Two houses were damaged by aircraft impact and fire, but no injuries were sustained by persons on the ground. The probable cause of this accident was the in-flight failure of the left wing which resulted from a preexisting fatigue crack in the left-wing lower spar cap. The fatigue crack was present during inspections of the spar cap for cracks conducted prior to the accident, but it was not detected during these inspections. Author

N73-16007*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTER PROGRAMS FOR ESTIMATION OF STOL TAKEOFF, LANDING, AND STATIC PERFORMANCE
Susan E. Post Dec. 1972 66 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62217) Avail: NTIS HC $5.50 CSCL 01B

A set of computer programs has been developed for evaluating the performance of powered-lift STOL aircraft. Included are a static performance summary and dynamic calculations of takeoff and landing performance. The input, output, options, and calculations for each program are described. The programs are written in FORTRAN IV and are currently available on TSS 360. Three independent sections are presented corresponding to the three programs: (1) static performance, (2) takeoff performance, and (3) landing performance. Author

N73-16008*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
MODELING OF AIRPLANE PERFORMANCE FROM FLIGHT-TEST RESULTS AND VALIDATION WITH AN F-104G AIRPLANE
Robert T. Marshall and William G. Schweikhard Washington Feb. 1973 30 p refs
(NASA-TN-D-7137; H-723) Avail: NTIS HC $3.00 CSCL 01B

A technique of defining an accurate performance model of an airplane from limited flight-test data and predicted aerodynamic and propulsion system characteristics is developed. With the modeling technique, flight-test data from level accelerations are used to define a 1g performance model for the entire flight

envelope of an F-104G airplane. The performance model is defined in terms of the thrust and drag of the airplane and can be varied with changes in ambient temperature or airplane weight. The model predicts the performance of the airplane within 5 percent of the measured flight-test data. The modeling technique could substantially reduce the time required for performance flight testing and produce a clear definition of the thrust and drag characteristics of an airplane. Author

N73-16009*# Aerospace Corp., El Segundo, Calif. Air Transportation Group.
STUDY OF V/STOL AIRCRAFT IMPLEMENTATION. VOLUME 2: APPENDICES
A. Androsky, S. C. Miller, J. A. Neiss, W. J. Portenier, and H. M. Webb Nov. 1972 315 p refs
(Contract NAS2-6473)
(NASA-CR-114518; ATR-73(7303)-1-Vol-2-App) Avail: NTIS HC $17.75 CSCL 01B

An analysis of V/STOL aircraft implementation and utilization is presented. The subjects discussed are: (1) short haul air transportation requirements, (2) available aircraft technology, (3) aircraft production requirements, (4) airport requirements, (5) roles and responsibilities, and (6) cost and funding. Author

N73-16010*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
EXPLICIT DETERMINATION OF LATERAL-DIRECTIONAL STABILITY AND CONTROL DERIVATIVES BY SIMULTANEOUS TIME VECTOR ANALYSIS OF TWO MANEUVERS
Glenn B. Gilyard Washington Feb. 1973 12 p refs
(NASA-TM-X-2722; H-751) Avail: NTIS HC $3.00 CSCL 01B

An extension of the time vector technique for determining stability and control derivatives from flight data is formulated. The technique provides for explicit determination of derivatives by means of simultaneous analysis of two maneuvers which differ by a dependent control input. The control derivatives for the dependent input are also explicitly determined. This extended technique is preferable to the application of the time vector method to single maneuvers in that no estimates of derivatives are required. An example illustrating the application of the technique is given. Author

N73-16011*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-FREQUENCY REAR QUADRANT NOISE OF A TURBOJET ENGINE WITH EXHAUST DUCT MUFFLING
Richard P. Woodward and Gene L. Minner Washington Feb. 1973 21 p refs
(NASA-TM-X-2718; E-7202) Avail: NTIS HC $3.00 CSCL 20A

A J-65 engine was run with a tuned sound-absorbing exhaust duct to study the internal and jet components of rear quadrant noise. Full muffler, hard wall duct, and regular production engine configurations were tested. The jet exhaust velocities were subsonic. The use of the exhaust muffler extended the relation between the jet noise and the eighth power of the jet velocity to lower velocities than for the hard wall duct. Author

N73-16012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECTS OF CONFIGURATION CHANGES ON THE AERODYNAMIC CHARACTERISTICS OF A FULL-SCALE MOCKUP OF A LIGHT TWIN ENGINE AIRPLANE
Marvin P. Fink, James P. Shivers, H. Douglas Greer, and James L. Megrail (Army Air Mobility Res. and Develop. Lab., Fort Eustis, Va.) Washington Sep. 1972 223 p refs
(NASA-TN-D-6896; L-8375) Avail: NTIS HC $3.00 CSCL 01C

Wind tunnel tests of a full-scale model of a light twin engine aircraft were conducted. The angle of attack was varied from minus 4 degrees to plus 20 degrees. The sideslip range was plus or minus 8 degrees. Thrust coefficients were 0, 0.20, and 0.44. Tests were made with various nacelle configurations, modes of propeller rotation, orientation of the thrust axis, and airfoil section at Reynolds numbers of 2.96 times one million and 2.05 times one million. Author

N73-16013*# Mount Auburn Research Associates, Inc., Newton Upper Falls, Mass.
GODUNOV METHOD AND COMPUTER PROGRAM TO DETERMINE THE PRESSURE AND FLOW FIELD ASSOCIATED WITH A SONIC BOOM FOCUS
Lee W. Parker and Robert G. Zalosh Washington NASA Jan. 1973 109 p refs
(Contract NAS1-10276)
(NASA-CR-2127) Avail: NTIS HC $3.00 CSCL 20A

A computer method has been developed to calculate the flow field associated with sonic boom focusing. Solutions are obtained for focussing caused by localized cold spots in the atmosphere, as well as for N-waves with concave fronts. Results include focus factors and the length scales of the focal region. Both strong and weak shock waves are studied. Author

N73-16014*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PITCH ATTITUDE, FLIGHT PATH, AND AIRSPEED CONTROL DURING APPROACH AND LANDING OF A POWERED LIFT STOL AIRCRAFT
James A. Franklin and Robert C. Innis Dec. 1972 68 p refs
(NASA-TM-X-62203) Avail: NTIS HC $5.50 CSCL 01C

Analytical investigations and piloted moving base simulator evaluations were conducted for manual control of pitch attitude, flight path, and airspeed for the approach and landing of a powered lift jet STOL aircraft. Flight path and speed response characteristics were described analytically and were evaluated for the simulation experiments which were carried out on a large motion simulator. The response characteristics were selected and evaluated for a specified path and speed control technique. These charcteristics were: (1) the initial pitch response and steady pitch rate sensitivity for control of attitude with a pitch rate command/ attitude hold system, (2) the initial flight path response, flight path overshoot, and flight path-airspeed coupling in response to a change in thrust, and (3) the sensitivity of airspeed to pitch attitude changes. Results are presented in the form of pilot opinion ratings and commentary, substantiated where appropriate by response time histories and aircraft states at the point of touchdown. Author

N73-16015*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
INVESTIGATION OF SOME PARAMETERS AFFECTING THE STABILITY OF A HINGELESS HELICOPTER BLADE IN HOVER
Peretz Friedmann Aug. 1972 19 p refs
(Contract NAS2-6175)
(NASA-CR-114525; ASRL-TR-166-4) Avail: NTIS HC $3.00 CSCL 01B

Equations of motion are used to investigate the effects of the choice of the mode shape and built-in coning angle on the stability boundaries of hingeless blades in hover. The results obtained indicate that the stability boundaries are dependent upon the mode shape to a considerable degree. It was also found that positive built-in coning is usually destabilizing while a negative amount of built-in coning can be quite stabilizing. Author

N73-16016# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
RECENT STUDIES ON METEOROLOGICAL ICING PARAMETERS [NEUERE UNTERSUCHUNGEN AUF DEM GEBIET DER METEOROLOGISCHEN VEREISUNGSPARAMETER]
W. Kleuters 12 Sep. 1972 37 p refs In GERMAN Presented at the 5th DGLR Ann. Meeting, Berlin, 4-6 Oct. 1972
(MBB-UH-11-72-O; DGLR-Paper-72-109) Avail: NTIS HC $4.00

Natural ice formation conditions were investigated during test flights of the Transall C-160 in 1969 and 1970. The meteorological icing parameters, free water content, drop diameter and temperature have been measured. A special device was used for measuring free water content, which was reliable at high temperature and high water content. The data were evaluated statistically according to NACA/TN2738 and the results compared with the values in FAR25, Appendix C. It is shown that for high temperature and water content there are great differences, which can be traced back to the measuring equipment used by

NACA, a rotating multicylinder, which does not function satisfactorily for high water content. Author (ESRO)

N73-16017# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
COMPARISON BETWEEN STOL AIRCRAFT WITH MECHANICAL HIGH-LIFT SYSTEMS AND STOL AIRCRAFT WITH BLOWN FLAP WINGS [STOL-FLUGZEUGE MIT MECHANISCHEN HOCHAUFTRIEBSYSTEMEN IM VERGLEICH ZU STOL-FLUGZEUGEN MIT BLASKLAPPENFLUEGELN]
E.-A. Bielefeldt 20 Sep. 1972 35 p refs In GERMAN Presented at the 5th DGLR Ann. Meeting, Berlin, 4-6 Oct. 1972
(MBB-UH-12-72-O; DGLR-Paper-72-057) Avail: NTIS HC $3.75

The net lift of modern mechanical high lift devices and externally blown flaps applied to STOL aircraft is compared. The possibilities of achieving higher aerodynamic efficiencies with these high lift devices are discussed. Aerodynamic installation problems and influence of the installation weights of several devices on the net lift are surveyed. The net lift of complex mechanical and blown flap systems is determined for a STOL aircraft, which has a wing loading of 370 kp/sq m and a maximal lift coefficient in trimmed situation of about 3.5. It is shown that for this case mechanical high lift devices are superior to blown flaps. Author (ESRO)

N73-16018# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
INFLUENCE OF AIRWORTHINESS REGULATIONS ON TAKEOFF AND LANDING PERFORMANCE OF QSTOL AIRCRAFT [EINFLUSS VON LUFTTUECHTIGKEITSVORSCHRIFTEN AUF DIE START- UND LANDELEISTUNGEN VON QSTOL-FLUGZEUGEN]
Heinz G. Klug 20 Sep. 1972 25 p In GERMAN Presented at the 5th DGLR Ann. Meeting, Berlin, 4-6 Oct. 1972
(MBB-UH-13-72-O; DGLR-Paper-72-056) Avail: NTIS HC $3.25

The decisive influence of the requirements and assumptions with regard to takeoff and landing performance on the design of QSTOL aircraft is shown by using a typical example of an aircraft with externally blown flaps. This aircraft would need less than 500 m runway length according to one set of rules, and according to another set nearly 1000 m. The influence of different regulations on the determination of the lowest allowable velocities in flying over obstacles is represented and explained. Aircraft with blown flaps are very sensitive to this, and the whole comparison between different concepts can be distorted. A physically based set of regulations is required. Author (ESRO)

N73-16019# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF FLIGHT DYNAMICS USING PROBLEM ORIENTED PROGRAM LANGUAGES [UNTERSUCHUNG DER FLUGZEUGDYNAMIK MIT HILFE BLOCKORIENTIERTER PROGRAMMIERSPRACHEN]
H. Friedrich, H. Munser, and W. Kohl Bonn Bundeswehramt 1972 159 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-72-21) Avail: NTIS HC $10.00; Bundeswehramt 25 DM

A problem oriented program was tested for its application to digital simulation in flight dynamics investigations. These investigations are based on conventional computering methods with small perturbations theory and on simulation. A digital simulation language is suggested as a link between the two methods. The possibilities of CSMP, a problem oriented IBM program, were examined with the aid of two reference aircraft, Fiat G-91 and Dornier Do-31. The programming and testing are described, and all the possibilities available in flight dynamics with this computing technique are demonstrated. Cost aspects are mentioned. ESRO

N73-16020# Intermetrics, Inc., Cambridge, Mass.
PWI (PILOT WARNING INDICATORS) SYSTEMS SURVEY Final Report, Apr. - Nov. 1971
James H. Flanders, Peter A. Grundy, and Neal A. Carlson Nov. 1971 151 p refs
(Contract DOT-TSC-188)
(PB-212496; DOT-TSC-188-2) Avail: NTIS HC $3.00 CSCL 01B

The survey is presented, using a compilation, classification, and review of 176 documents related to PWI and CAS research and development. Subject categories include: CAS system references; PWI system references; proceedings and literature searches; facilities and programs; and atmospheric physics. A multidimensional classification code for CAS and PWI systems is also included. Author (GRA)

N73-16021# Princeton Univ., N.J.
HELICOPTER STATION KEEPING Final Task Report, Sep. 1966 - 30 Dec. 1971
Theodor A. Dukes Sep. 1972 95 p refs
(Contract DA-28-043-AMC-02412(E); DA Proj. 1H1-62202-A-219)
(AD-751459; ECOM-02412-9) Avail: NTIS CSCL 01/2

A discussion of all aspects of formation flight, from initiation to termination, leads to an emphasis on the station keeping control loop. The most essential topics are brought into focus in order to reveal and to emphasize the basic relationships which must be considered in decisions about formation flight system features and requirements. The significance of leader-to-follower data communication is explored in detail. Nominal station keeping trajectories are defined in terms of the motion of a nominal point coordinate system. The information available to the follower determines his ability to calculate the location and orientation of the nominal coordinate system, i.e., his position errors. The need to know the reference orientation at low speeds and hover is shown. Acceleration errors are estimated based on a simple model for the positioning control loop, and relatively narrow ranges of gains and bandwidth are found feasible. Improvements can be made if leader information is available and utilized.
Author (GRA)

N73-16022# Princeton Univ., N.J.
A DYNAMIC HELICOPTER PERFORMANCE AND CONTROL MODEL Final Task Report, 1 Sep. 1966 - 30 Dec. 1971
G. J. Born, D. Carico, and E. J. Durbin Aug. 1972 66 p refs
(Contract DA-28-043-AMC-02412(E); DA Proj. 1H1-62202-A-219)
(AD-751460; ECOM-02412-11) Avail: NTIS CSCL 01/3

The report gives the results of the development of a dynamic helicopter performance and control model. The dynamic performance model is obtained by using the force and rotor aerodynamic equations. This performance model together with the moment balance and control equations are used as a basis for a helicopter control model. This model can be used for over relatively large speed range and varying rotor rpm. As an example, an analog computer simulation is made for a UH-1C helicopter, performing a steep descent maneuver, close to autorotation boundary. Author (GRA)

N73-16023# ARO, Inc., Arnold Air Force Station, Tenn.
POST-STALL TESTING OF AIRCRAFT WITH A WIND TUNNEL CAPTIVE SYSTEM Final Report, Feb. - Jun. 1972
J. R. Milillo AEDC Nov. 1972 21 p refs
(Contract F40600-73-C-0004; ARO Proj. PW5284)
(AD-751461; ARO-PWT-TR-72-115; AEDC-TR-72-126) Avail: NTIS CSCL 01/3

High-speed aircraft may have unsatisfactory stall characteristics and the aircraft may be lost because of the uncontrolled flight gyrations encountered in attempting to maneuver in the stalled flight regime. Results are presented of a study to determine the feasibility of using a captive technique in a wind tunnel to study aircraft post-stall characteristics and to define boundaries for maintaining controlled flight of the aircraft. The technique appears feasible but needs to be developed by conducting pilot tests in an existing faci'ity. Author (GRA)

N73-16024# Defense Documentation Center, Alexandria, Va.
AIRCRAFT LANDINGS Report Bibliography, Jan. 1970 - Apr. 1972
Nov. 1972 156 p refs
(AD-751800; DDC-TAS-72-50) Avail: NTIS CSCL 01/2

The bibliography contains unclassified references on Aircraft Landings. These references deal with carrier controlled radar,

carrier landings, instrument landings, approach, night landings, ground controlled radar, landing lights, display systems, control systems, glide path systems, human factors, and landing lights. Corporate Author-Monitoring Agency, Subject, Personal Author and Title Indexes are provided. Author (GRA)

N73-16025# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
FIRE DETECTION SYSTEM PERFORMANCE IN USAF AIRCRAFT Final Technical Report, Mar. - Sep. 1971
Charles Delaney Aug. 1972 26 p refs
(AD-751346; AFAPL-TR-72-49) Avail: NTIS CSCL 01/3

The report is concerned with the determination of the performance of fire detection systems in USAF aircraft. Data on false fire warnings and aircraft engine nacelle fires were taken from Air Force accident/incident reports. These data included the time period 1965 through 1970 and is restricted to noncombat related accidents/incidents. Analysis of the data showed that false fire warnings are a major problem in the majority of USAF aircraft (83% of all reported alarms are false). These false fire warnings resulted in damage or destruction to aircraft as well as crew injuries/fatalities. In addition, it was found that in approximately 50% of the engine nacelle fires, where the performance of the detection system could be determined, the system did not provide an alarm. It was also found that the fire detection system in a number of aircraft had been partially or totally removed to reduce or eliminate the false fire warning problem. As a consequence the majority of the fires which occurred in these aircraft were not detected. Author (GRA)

N73-16026# Dunlap and Associates, Inc., Darien, Conn.
PREDICTIVE AND ADAPTIVE PROCESSES IN THE CONTROL OF AIR FORCE SYSTEMS Final Report
Charles R. Kelley 30 Sep. 1972 19 p
(Contract F44620-72-C-0006; AF Proj. 9778)
(AD-751306; AFOSR-72-2037TR) Avail: NTIS CSCL 01/3

The project has been concerned with prediction and adaptation in control of systems such as military aircraft. The processes were explored in human operators, in adaptive displays for the human operator and in a means for coupling manual with automatic control. The latter development, termed automanual control, was mechanized and tested in the laboratory. Automanual control with a predictor instrument proved superior to four other modes of control to which it was compared. Author (GRA)

N73-16027# Boeing Co., Morton, Pa. Vertol Div.
USE OF THE FINITE ELEMENT DAMPED FORCED RESPONSE STRAIN ENERGY DISTRIBUTION FOR VIBRATION REDUCTION
John J. Sciarra and Robert G. Ricks 1972 30 p refs Presented at AROD Mil. Theme Rev. The Helicopter and V/STOL Aircraft Res. Conf., Moffett Field, Calif., 26-27 Sep. 1972
(Contract DAHC04-71-C-0048)
(AD-751809; AROD-9621-1-E) Avail: NTIS CSCL 01/3

Expressions for the vibratory strain energy distribution using the damped forced response (DFR) are developed. The modes above and below the excitation frequency are analyzed separately. The results are then combined to establish criteria for structural optimization. A helicopter forward pylon structural model is used to demonstrate the advantages of the DFR strain energy concept for structural vibrational optimization.
Author (GRA)

N73-16028# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COORDINATE STABILIZATION FOR A FLEXIBLE AIRCRAFT DURING FLIGHT IN A TURBULENT ATMOSPHERE
V. V. Udilov 8 Sep. 1972 13 p refs Transl. into ENGLISH from the mono. "Primenenie Invariantnykh Sistem Avtomatiches-kogo Upravleniya" Moscow, Izd-vo Nauka, 1970 p 221-231
(AD-751148; FTD-HT-23-863-72) Avail: NTIS CSCL 01/4

The problem is considered of automatically controlling aircraft altitude and pitch angle in the duck system. The aircraft dynamics are described by a system of linear differential equations with constant coefficients: three equations of motion of the center of gravity and rotation of the aircraft as a solid body, and a combination of equations for the flexible oscillations of an elastic fuselage in the plane of longitudinal symmetry. It is assumed that the autopilot acts on the flaps in changing the pitch and attack angles, the generalized coordinates characterizing the bending oscillations of the fuselage, and the nose controlling surface, as well as in changing the slope of the trajectory.
Author (GRA)

N73-16029# Lockheed Missiles and Space Co., Sunnyvale, Calif. Ground Vehicle Systems.
HIGH PERFORMANCE HELICOPTER HOIST PROGRAM Final Report
Louis J. Lawson, J. H. Duddy, R. R. Gilbert, M. R. Helvey, E. H. Jacobsen, R. Ruth, and W. T. Wada Aug. 1972 169 p refs
(Contract DAAD05-72-C-0099)
(AD-751217; LMSC-D267477; LWL-CR-02M72) Avail: NTIS CSCL 01/3

The report presents a feasibility study on a flywheel powered personnel rescue hoist for helicopters. It includes investigations of flywheel configurations, materials, and associated equipment including bearings, seals, and pumps. Also included are discussions of human factors considerations and design considerations affecting component selection, hoist configuration, and hoist installation. Particular attention is given to the capability of a 13.5-lb, 73.5 w-hr flywheel to provide the short duration high power required to affect rescue hoisting speed as high as 500 ft per min. without overtaxing the helicopter's limited accessory power capacity. Author (GRA)

N73-16904 Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
A RELATION BETWEEN MEASURED CENTER OF GRAVITY VERTICAL ACCELERATIONS AND THE LOADS AT THE T-TAIL OF A MILITARY AIRPLANE
Otto Buxbaum *In* AGARD Symp. on Random Load Fatigue Oct. 1972 16 p refs (For availability see N73-16896 07-32)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-16030*# ESB, Inc., Yardley, Pa.
ALKALINE BATTERY SEPARATOR CHARACTERIZATION STUDIES Final Report
J. Kelly, S. Orenstein, and W. Bulla Jun. 1972 90 p refs
(Contract NAS5-10418)
(NASA-CR-130154) Avail: NTIS HC $6.50 CSCL 10C

The second phase of an investigation of available alkaline battery separators describes the results of characterization testing of membrane and absorbent separators. A polyvinyl alcohol film and two grated polyethylenes were found to have characteristics which recommend their use in alkaline silver batteries. Among the absorbent separators, four materials were chosen for battery testing in sealed nickel cadmium cells. Choice was based on chemical stability, electrochemical properties and wetting characteristics. Author

N73-16031*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF PROTON IRRADIATION AND TEMPERATURE ON 1 OHM-cm AND 10 OHM-cm SILICON SOLAR CELLS
Carmen Nicoletta Jan. 1973 42 p refs
(NASA-TM-X-66169; X-765-73-25) Avail: NTIS HC $4.25 CSCL 10A

The 1 ohm-cm and 10 ohm-cm silicon solar cells were exposed to 1.0 MeV protons at a fixed flux of 10 to the 9th power P/sq cm-sec and fluences of 10 to the 10th power, 10 to the 11th power, 10 to the 12th power and 3 X 10 to the 12th power P/sq cm. I-V curves of the cells were made at room temperature, 65 C and 165 C after each irradiation. A value of 139.5 mw/sq cm was taken as AMO incident energy rate per unit area. Degradation occurred for both uncovered 1 ohm-cm and 10 ohm-cm cells. Efficiencies are generally higher than those of comparable U.S. cells tested earlier. Damage (loss in maximum

power efficiency) with proton fluence is somewhat higher for 10 ohm-cm cells, measured at the three temperatures, for fluences above 2 X 10 to the 11th power P/sq cm. Cell efficiency, as expected, changes drastically with temperature. Author

N73-16032*# Honeywell, Inc., Montgomeryville, Pa. Power Sources Center.
HIGH ENERGY DENSITY PRIMARY BATTERIES Final Report
R. J. Horning and W. R. Beck 2 Oct. 1972 277 p
(Contract NAS3-13221)
(NASA-CR-120857) Avail: NTIS HC $16.00 CSCL 10C

By the use of fractional factorials, paths of steepest ascent and direct comparison experimentation, performance characteristics of the CuF2/LiAsF6-MF/Li electrochemical system were optimized under conditions of temperature environment, discharge rate, active stand, and use of anhydrous cathodes. Two hundred ampere-hours/lb of CuF2 and 600 watt-hours/lb of CuF2 were achieved in anhydrous cells at plus 40 C and at a discharge rate of 10 ma sq cm. Electrical performance is primarily altered by temperature and discharge rate; however, other factors such as cathode water content, cathode conductor content, separator thickness, and the use of SO2 gas also have significant effects. Author

N73-16033# Sandia Labs., Albuquerque, N.Mex.
LONG LIFE, WIDE TEMPERATURE RANGE ORGANIC ELECTROLYTE BATTERY
Samuel C. Levy 1972 3 p refs Presented at 142d Natl. Fall Meeting of the Electrochem. Soc., Miami Beach, Fla., 8 Oct. 1972 Sponsored by AEC
(SC-DC-722298; Conf-721008-1) Avail: NTIS

A study was undertaken to find a battery system capable of a long life (1100 hours) at low current drains (4 mA), with intermittent pulses (50 per hour, 60 msec duration, 430 mA; and 8 per day, 20 sec duration, 430 mA), over a wide temperature range (-10 to +60 C), for certain military applications. The lithium-silver chloride couple was chosen for this investigation. An electrolyte screening program was conducted, using aprotic solvents alone and in binary mixtures. On the basis of conductivity studies over the temperature range -10 to +60 C, lithium stability tests at +60 C and single cell discharges at the 10-day rate, the electrolyte 80% tetrahydrofuran/20% propylene carbonate/saturated lithium hexafluoroarsenate was selected for use in this program. Author

N73-16034# California Univ., Berkeley. Lawrence Berkeley Lab.
DESIGN CRITERIA FOR SOLID ELECTROLYTE ELECTROCHEMICAL CELLS M.S. Thesis
Richard Wyrant Headrick Jul. 1972 78 p refs
(Contract W-7405-eng-48)
(LBL-839) Avail: NTIS

Factors affecting the accuracy of galvanic cells involving solid electrolytes in thermochemical measurements were studied with regard to cell design and operation. The cells exhibiting low and high entropies of reaction were examined for critical parameters. The galvanic cells were based on the closed cell concept involving sealed electrode compartments. Author

N73-16035# Energy Research Corp., Bethel, Conn.
SECONDARY ZINC-OXYGEN BATTERIES Final Report
Martin Klein Oct. 1972 63 p refs
(Contract DAAB07-71-C-0249)
(AD-751751; ECOM-0249-F) Avail: NTIS CSCL 10/3

The purpose of this contract was to conduct research and development leading to the construction of a long life high energy density sealed zinc-oxygen secondary battery which is capable of operating over the range of temperatures and rates compatible with Army communications and surveillance equipment. Discussed are the following: Investigations and screening of inorganic separator materials, Optimization of the rechargeable zinc electrodes; Investigation of various rechargeable oxygen electrode schemes; and Design, fabrication and testing of lightweight sealed 25 ampere-hour zinc-oxygen cells. GRA

N73-16036# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ENIN-2 EXPERIMENTAL OPEN CYCLE MHD GENERATOR RIG
D. G. Zhimerin, V. A. Bashilov, and V. P. Motulevich 25 Aug. 1972 15 p Transl. into ENGLISH from MHD Symp. (Warsaw), v. 1, 1968 p 2821-2829
(AF Proj. G101)
(AD-751251; FTD-HT-23-559-72) Avail: NTIS CSCL 10/2

An experimental rig has been set up to study the processes taking place in the duct of an open-cycle MHD generator. The installation consists of a combustion chamber unit in which natural gas is oxidized in an air atmosphere enriched with oxygen (to pure O2) with ionizing seeds of different types. The pressure in the duct can go up to 50 atm and the temperature to 3500K. Both the oxygen and the gas are collected in containers of 14 and 3.5 tons capacity, respectively. As the combustion products pass into the duct, the nozzle system can vary the Mach number from subsonic to approximately 3. The duct has a rectangular cross-section. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-16037*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 108, NOVEMBER 1972
Nov. 1972 101 p refs
(NASA-SP-7011(108)) Avail: NTIS HC $3.00 CSCL 06E

This special bibliography lists 326 reports, articles, and other documents introduced into the NASA scientific and technical information system in Oct. 1972. Author

N73-16038*# Missouri Univ., Columbia. Space Sciences Research Lab.
THE ROLE OF DEPRESSED METABOLISM IN INCREASED RADIO RESISTANCE Semiannual Status Report
X. J. Musacchia 14 Sep. 1972 81 p refs
(Grant NGL-26-004-021)
(NASA-CR-130381) Avail: NTIS HC $6.25 CSCL 06C

Studies are presented of the physiology of depressed metabolism, radio-resistance in depressed metabolic states, comparative aspects of depressed metabolism, and gastrointestinal responses to ionizing radiation. Specific data cover helium-cold induced hypothermia in white rats and hamsters, and radiation responses and intestinal absorption in the gerbil. Author

N73-16039*# Wisconsin Univ., Madison. Dept. of Electrical Engineering.
NONINVASIVE MEASUREMENT OF CENTRAL VENOUS PRESSURE Semiannual Status Report, 1 May - 31 Oct. 1972
John G. Webster and S. Martin Mastenbrook, Jr. Nov. 1972 21 p refs
(Grant NGR-50-002-204)
(NASA-CR-130348) Avail: NTIS HC $3.25 CSCL 06E

A technique for the noninvasive measurement of CVP in man was developed. The method involves monitoring venous velocity at a point in the periphery with a transcutaneous Doppler ultrasonic velocity meter while the patient performs a forced expiratory maneuver. The idea is the CVP is related to the value of pressure measured at the mouth which just stops the flow in the vein. Two improvements were made over the original procedure. First, the site of venous velocity measurement was shifted from a vein at the antecubital fossa (elbow) to the right external jugular vein in the neck. This allows for sensing more readily events occurring in the central veins. Secondly, and perhaps most significantly, a procedure for obtaining a curve of relative mean venous velocity vs mouth pressure was developed. Author

N73-16040*# George Washington Univ., Washington, D.C. Dept. of Medical and Public Affairs.
A BIBLIOGRAPHY OF WILDLIFE MOVEMENTS AND

TRACKING SYSTEMS
Morton Werber Sep. 1970 78 p refs
(Grant NSR-09-010-027)
(NASA-CR-130380) Avail: NTIS HC $6.00 CSCL 06C

A bibliography is presented consisting of 1,005 references concerned with animal orientation, homing, navigation, migration, and home range movements, and the various methods of tracking and monitoring such behavior through biotelemetry, radar, and various banding and tagging techniques. A majority of the publications appeared between 1950 and 1970, although the most intensive search was made of the 1965-1970 period. A small number of older articles and books were included because they appeared to have some special or unusual value. The references have been organized in two ways. First, they are grouped in primary categories on the basis of the behavior involved such as orientation, homing, etc., and the methods of tracking. Second, within each of the resulting major areas, the items are arranged in terms of the species of animal. This sequence is maintained throughout the bibliography and in many cases represents a rank order according to the number of publications found. Author

N73-16041# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND MEDICINE, VOLUME 6, NO. 6, 1972
18 Jan. 1973 140 p refs Transl. into ENGLISH from Kosm. Biol. Med. (USSR), v. 6, no. 6, Nov.-Dec. 1972 p 1-82
(JPRS-58010) Avail: NTIS HC $9.00

Articles are presented on space biology and medicine which include: research aimed at guaranteeing safety on long flights and reliability of the human component of the man-spaceship system; space psychology and physiology; spacecraft habitability; and effects of radiation and weightlessness. For individual titles, see N73-16042 through N73-16058.

N73-16042 Joint Publications Research Service, Arlington, Va.
FIFTIETH ANNIVERSARY OF FORMATION OF THE UNION OF SOVIET SOCIALIST REPUBLICS c34
A. N. Babiychuk *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 1-6 (For availability see N73-16041 07-04)

An overview is presented on the formation of the U.S.S.R. and the notable accomplishments which have been attained since its creation. Emphasis is placed on developments in the field of science and in particular that of space medicine. A brief chronology is given of Soviet rocket flights in which animals were utilized for biological experiments and which marked the beginning of solution of a variety of problems in supporting manned space flights. D.L.G.

N73-16043 Joint Publications Research Service, Arlington, Va.
RENAL COMPONENT OF THE ANTIGRAVITATIONAL FUNCTION IN THE BODY
G. S. Belkaniya *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 7-16 refs (For availability see N73-16041 07-04)

Numerous experiments are cited in which the results indicate that it is possible to define two principal relatively independent regulation systems in the renal component of the antigravitational function. The first system (aldosterone, antidiuretic hormone, kidneys) smooths the blood circulating volume by means of the activation of the antidiuretic and (antinatriuretic) reflexes. The second system (renin, angiotensin, circulation) alters the tone of the smooth muscles of vessels and levels out the gravity hydrostatic effect. These two relatively independent systems are linked through aldosterone because its secretion is also stimulated by angiotensin. The close interaction of the systems, including all their interconnections, makes it possible to define them as the regional functional system in the general antigravity mechanism. Author

N73-16044 Joint Publications Research Service, Arlington, Va.
EFFECT OF ACCELERATIONS ON THIAMINE-S-35 DISTRIBUTION IN THE BODIES OF WHITE MICE
V. N. Totskiy and L. M. Rovner *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 17-25 refs (For availability see N73-16041 07-04)

The radioactivity of the blood (plasma and formed elements), organs (brain, heart, liver, kidneys, small intestine, spleen) and the subcellular fraction of liver cells of white mice was examined at different intervals following thiamine S-35 injections (1 mg/kg) in normal animals and animals pre-exposed to accelerations (5.5-6 g). Considerable changes in thiamine S-35 distribution within organs, cells and subcellular structures were observed after the exposure. These changes may be caused by disturbances in vitamin metabolism, as well as shifts in the permeability of histohematic barriers, cellular and subcellular membranes. Author

N73-16045 Joint Publications Research Service, Arlington, Va.
MORPHOLOGICAL CHANGES IN THE JUXTAGLOMERULAR APPARATUS IN THE KIDNEYS OF RATS DURING MULTIHOUR EXPOSURE TO ACCELERATIONS IN DIFFERENT DIRECTIONS
A. S. Pankova *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 26-30 refs (For availability see N73-16041 07-04)

The modified Bovi method was used in estimating the juxtaglomerular index, the dynamics of change in the content of granules in juxtaglomerular cells in the kidneys, using 76 male rats exposed to longitudinal and transverse accelerations of 4 g for 3, 8, 16 and 24 hours. Morphological indications of juxtaglomerular apparatus secretory activity were detected. They were more distinct upon exposure to longitudinal accelerations. The part played by the juxtaglomerular apparatus in the control of hemodynamics and the fluid-electrolyte balance during accelerations is discussed. Author

N73-16046 Joint Publications Research Service, Arlington, Va.
HEAT REGULATION REACTIONS IN RATS IN A HYPOXIC ATMOSPHERE WITH NITROGEN AND HELIUM DILUTION
G. V. Troshikhin *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 31-37 refs (For availability see N73-16041 07-04)

Thermoregulation reactions (gas exchange, thermoregulation activity of muscles and rectal temperature) of 60 rats exposed for one hour to nitrogen and helium atmospheres containing 20.9, 11.4 and 7.4% oxygen were investigated at 5 = 25 C. In comparison with the controls (breathing air) the test animals exposed in the helium-oxygen (21%) atmosphere exhibited an increase in gas exchange and thermoregulation activity of muscles and a decrease in rectal temperature, thus indicating a cooling effect of helium. Exposure of rats to a hypoxic helium-oxygen (11.4%) atmosphere, as compared with a similar nitrogen-oxygen gas mixture, brought about a less distinct decline in gas exchange and a more marked decrease in body temperature, the thermoregulation tone varying insignificantly and tending to increase in the helium-oxygen atmosphere. Exposure of rats to a hypoxic helium-oxygen (7.4%) atmosphere, as compared with a similar nitrogen-oxygen gas mixture, induced a more noticeable decrease in gas exchange and body temperature, the thermoregulation activity of the muscles changing insignificantly and tending to decrease in the nitrogen-oxygen atmosphere. Author

N73-16047 Joint Publications Research Service, Arlington, Va.
PATHOGENESIS OF SOME RESPIRATORY AND CIRCULATORY REACTIONS ACCOMPANYING DROPS IN BAROMETRIC PRESSURE
G. B. Bogoslovov *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 38-42 refs (For availability see N73-16041 07-04)

Decompression disease continues to remain a timely problem in high-altitude and space flights. In 44 experiments on dogs the reactions of respiration, blood circulation, gas composition of the blood, and a number of other indices were studied in response to embolism in the pulmonary artery induced by different quantities of nitrogen introduced at different rates (as a model of a decompression gas embolism). Some of the animals were first intravenously injected with Novocaine. A satisfactory tolerance of the animals to a gas embolism was established. In the reactions to gas injection it is not so much the quantity which is of importance as the rate of entry into the lesser circulatory system. The deactivation of vascular interceptors by Novocaine depresses the adaptive compensatory reactions of respiration and circulation developing after injection of the gas and leads to a predominance

of symptoms of mechanical impairment of pulmonary circulation. Author

N73-16048 Joint Publications Research Service, Arlington, Va.
MORPHOLOGICAL CHANGES IN THE TESTES OF DOGS ACCOMPANYING CHRONIC AND COMBINED GAMMA IRRADIATION
G. I. Plakhuta-Plakutina, Ye. A. Savina, and N. L. Fedorova *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 43-51 refs (For availability see N73-16041 07-04)

A study was made of the state of spermatogenesis and sperm production in 36 dogs exposed to chronic (in doses of 21, 62.5 and 125 rad/year) and combined (constant irradiation of 62.5 rad/year and acute radiation in doses of 58 and 126 rad/year) gamma irradiation during the course of the year. The dynamics are described of qualitative and quantitative indices of sperm production during the course of the year and morphological changes in the testicles of dogs in dependence on dose intensity and the nature of irradiation. Suppression and impairment of the spermatogenesis process, combined with a decrease in sperm production indices, was expressed to the greatest degree with combined exposure to chronic and acute irradiation in a dose of 188.5 rad/year; evidence of an increase in the radiosensitivity of tissues in the testes in response to an additional radiation load. Author

N73-16049 Joint Publications Research Service, Arlington, Va.
EFFECT OF SOME DRUGS ON FALL-OUT AND BEKHTEREV NYSTAGMUS
Ye. L. Epshteyn *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 52-58 refs (For availability see N73-16041 07-04)

Guinea pigs were used in studying the effect of intramuscular injections of drugs on fall-out and Bekhterev nystagmus occurring after unilateral and bilateral labyrinthectomies. In unilaterally labyrinthectomized animals marezine and diphenydole decreased substantially the frequency of fall-out nystagmus, this being more distinct than in the case of scopolamine. In bilaterally labyrinthectomized animals scopolamine, marezine and metamysil considerably reduced the incidence of nystagmus, this being more significant than in the case of diphenydole and pediphen. A stage-by-stage investigation of the drug effect on unilateral and bilateral labyrinthectomy models makes it possible to determine specifically the peripheral and central components of each drug. Author

N73-16050 Joint Publications Research Service, Arlington, Va.
EFFECT OF PROLONGED HYPODYNAMIA ON RAT BIOLOGY
Ye. A. Stroganova *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 59-67 refs (For availability see N73-16041 07-04)

The effect of hypodynamia on the growth and development of offspring was studied in experiments on 36 rats. The test animals were housed in small cages for 62 days before mating. During this period the test animals lagged greatly behind the controls in their weight gain. Following exposure to hypodynamia the test animals changed their sexual behavior. During the first two days in the mating period the females were very aggressive toward the males. This accounted for the fact that the test females littered two or three days later than the controls.
Author

N73-16051 Joint Publications Research Service, Arlington, Va.
RADIATION OXIDATION OF WATER IMPURITIES IN MOISTURE-CONTAINING PRODUCTS OF MAN'S VITAL FUNCTIONS
N. V. Bychkov, A. N. Kasperovich, V. V. Krasnoshchekov, V. P. Plotnikova, Yu. Ye. Sinyak, V. F. Stolbov, S. V. Chizhov, and M. I. Shikina *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 68-73 refs (For availability see N73-16041 07-04)

A radiation method for purifying human wastes from organic impurities in the presence of hydrogen peroxide has been developed. The effect of radiation doses on the oxidation of organic impurities was studied. A toxicological evaluation of regenerated water was made. Author

N73-16052 Joint Publications Research Service, Arlington, Va.
REGULATION OF VERTICAL POSTURE AFTER FLIGHT ON THE SOYUZ-6 - SOYUZ-8 SHIPS AND 120 DAY HYPOKINESIA c05
Yu. N. Purakhin, L. I. Kakurin, V. S. Georgiyevskiy, B. N. Petukhov, and V. M. Mikhaylov *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 74-82 refs (For availability see N73-16041 07-04)

Control of erect posture was studied before and after the Soyuz-6 through Soyuz-8 flights (seven cosmonauts) and a 120-day bedrest experiment (ten test subjects). The study was performed using stabilographic methods and neurological tests; circulation reactions in cosmonauts were also examined. Coordination disturbances were revealed during flight and bedrest experiments. After the flight and experiment they increased and changes in statics and gait appeared. Stabilographic measurements revealed an increase in the amplitude and frequency (especially in the test subjects) of fluctuations of the general body center of mass. The cosmonauts exhibited an increase in pulse rate and arterial pressure. The test subjects also exhibited a pronounced automonic reaction. These changes were more distinct in the test subjects after the bedrest experiment. Author

N73-16053 Joint Publications Research Service, Arlington, Va.
MECHANICS OF RESPIRATION DURING SIMULATION OF WEIGHTLESSNESS IN AN IMMERSION MEDIUM
M. A. Tikhonov *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 83-87 refs (For availability see N73-16041 07-04)

Changes in lung capacity, air passage resistance and dynamic compliance during water immersion were investigated in six healthy male test subjects. At the beginning of the immersion experiment the functional residual capacity of the lungs decreased by an average of 7% and remained at that level until the end of the experiment. At the onset of the experiment lung compliance also decreased by an average of 20% but tended to recover by the end of immersion. At the beginning of the experiment air passage resistance increased by 65-80% and decreased slightly by the end of immersion. These changes may be caused by shifts in intrathoracic pressure and redistribution of the circulating blood volume. Author

N73-16054 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF SOME MECHANISMS OF MAN'S TOLERANCE TO LOWER BODY DECOMPRESSION c05
P. M. Suvorov and R. V. Beleda *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 88-93 refs (For availability see N73-16041 07-04)

The objective of the study was to reveal mechanisms underlying individual tolerance of human subjects to lower body negative pressure. Experiments were performed on 40 pilots and 14 test subjects. It was found that the different levels of human tolerance to LBNP of -50 or -77 mm Hg were related mainly to variability of the functional capacity of the human body to maintain arterial tone adequately. A study of catecholamines, their precursors and 17-hydroxycorticosteroids revealed a decline in functional activity of the sympathico-adrenal system and a decrease in adrenal cortex secretion of steroid hormones in subjects exhibiting low LBNP tolerance. These changes seemed to produce a rapid development of their cardiovascular dysfunction during LBNP. Author

N73-16055 Joint Publications Research Service, Arlington, Va.
EFFECT OF A GAS MIXTURE WITH AN INCREASED OXYGEN AND CARBON DIOXIDE CONTENT ON MAN'S ORTHOSTATIC TOLERANCE
V. I. Korolkov, A. A. Savilov, and I. Ya. Lunev *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 94-100 refs (For availability see N73-16041 07-04)

The test subjects were exposed to 10-day bedrest which resulted in a dropoff of orthostatic tolerance. Their exposure to a 95% O2 - 5% CO2 atmosphere during a 30-minute tilt test improved orthostatic tolerance, as indicated by hemodynamic parameters, gas composition and blood acid-base equilibrium.
Author

N73-16056 Joint Publications Research Service, Arlington, Va.
DIURNAL DYNAMICS OF PSYCHIC PERFORMANCE

DURING 72 HOUR CONTINUOUS WAKEFULNESS c05
A. L. Narinskaya *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 101-108 refs (For availability see N73-16041 07-04)

The results are given of studying variations in the mental performance of ten healthy male test subjects exposed to 72-hour continuous wakefulness. With respect to the different pattern of diurnal variations in mental performance two groups were distinguished: more rhythmic (four persons) and less rhythmic (six subjects). Author

N73-16057 Joint Publications Research Service, Arlington, Va.
USE OF SODIUM HYDROCARBONATE AS A MEANS FOR TREATING AND PREVENTING MOTION SICKNESS
V. N. Barnatskiy, I. I. Bryanov, R. M. Volosevich, D. P. Komarova, A. G. Kuznetsov, A. T. Poleshchuk, and I. G. Tazetdinov *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 109-117 refs (For availability see N73-16041 07-04)

The effectiveness of intravenous injections of sodium hydrocarbonate as a drug to prevent and treat motion sickness was tested in the laboratory, in clinics and under stormy weather conditions on the high seas. A positive effect of the drug was noted a few days after the injection and it persisted for several months. No pathological symptoms were observed after drug injection. The mechanism of the action of sodium hydrocarbonate during motion sickness still remains obscure and further studies are needed. Author

N73-16058 Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF THE EFFECT OF HIGH MOUNTAIN ALPINISM EXERCISES ON THE HUMAN BODY c05
G. R. Rung *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 118-128 refs (For availability see N73-16041 07-04)

The results are summarized of a study of 70 alpinists during their high-elevation ascents during 1965-1969. In studies with correction tables for the latent period of the oculomotor reaction, tremometry, strength and static endurance of the hands, and the functional state of the cardiovascular and respiratory systems an insignificant dropoff in these indices was detected during the early stages of high-elevation acclimatization, accompanied by an increase in general tolerance of the human body after a two-month stay in the mountains. Author

N73-16059*# Hardin-Simmons Univ., Abilene, Tex. Dept. of Biology.
A STUDY OF PSYCHROPHILIC ORGANISMS ISOLATED FROM THE MANUFACTURE AND ASSEMBLY AREAS OF SPACECRAFT TO BE USED IN THE VIKING MISSION Preliminary Report of Planetary Quarantine Activities, 1 Oct. - 31 Dec. 1972
Terry L. Foster and Luther Winans, Jr. Jan. 1973 30 p refs Presented at the Semiann. NASA Spacecraft Sterilization Technol. Seminar, New Orleans, 30-31 Jan. 1973
(Grant NGR-44-095-001)
(NASA-CR-130009) Avail: NTIS HC $3.50 CSCL 06M

The sampling of soils from the manufacture and assembly areas of the Viking spacecraft is reported and the methodology employed in the analysis of these samples for psychrophilic microorganisms, and temperature studies on these organisms is outlined. Results showing the major types of organisms and the percentage of obligate psychrophiles in each sample are given and discussed. Emphasis in all areas is toward application of these results to the objectives of the planetary quarantine program. Author

N73-16060*# West Florida Univ., Pensacola.
THE USE OF REMOTE SENSORS TO RELATE BIOLOGICAL AND PHYSICAL INDICATORS TO ENVIRONMENTAL AND PUBLIC HEALTH PROBLEMS
Sep. 1972 182 p refs
(Contract NAS9-11872)
(NASA-CR-128727) Avail: NTIS HC $11.25 CSCL 14B

Relationships between biological, ecological and botanical structures, and disease organisms and their vectors which might be detected and measured by remote sensing are determined. In addition to the use of trees as indicators of disease or potential disease, an attempt is made to identify environmental factors such as soil moisture and soil and water temperatures as they relate to disease or health problems and may be detected by remote sensing. The following three diseases and one major health problem are examined: Malaria, Rocky Mountain spotted fever, Encephalitis and Red Tide. It is shown that no single species of vascular plant nor any one environmental factor can be used as the indicator of disease or health problems. Entire vegetation types, successional stages and combinations of factors must be used. Author

N73-16061*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS FOR MICROBIOLOGICAL SAMPLING Patent Application
Judd R. Wilkins and Stacey M. Mills, inventors (to NASA) Filed 24 Jan. 1973 14 p
(NASA-Case-LAR-11069-1; US-Patent-Appl-SN-326198) Avail: NTIS HC $3.00 CSCL 06M

An automatic apparatus for microbiologically sampling surfaces using a cotton swab is reported which eliminates human error normally associated with this process. The apparatus includes a self powered transport device, such as a motor driven wheeled cart, which mounts a swabbing motor drive for a crank arm which supports a swab in the free end thereof. The swabbing motor is pivotally mounted and an actuator rod movable responsive to the cart traveling a predetermined distance provides lifting of the swab from the surface being sampled and reversal of the direction of travel of the cart. NASA

N73-16062*# Kanner (Leo) Associates, Redwood City, Calif.
ANALYSIS OF ELECTROCARDIOGRAMS OF RHESUS MONKEYS (MACACA MULATTA)
Y. Mu-Chen and S. Chia-Kiang Washington NASA Jan. 1973 21 p refs Transl. into ENGLISH from Sheng Li Hsueh Pao (Peking), v. 27, no. 2, Jun. 1964 p 189-198
(Contract NASw-2481)
(NASA-TT-F-14675) Avail: NTIS HC $3.25 CSCL 06C

Electrocardiograms were recorded for 107 normal Macaca mulatta monkeys of different age groups and both sexes. Standard, augmented unipolar, and unipolar precordial leads were used with all the animals unanesthetized and in the supine position. Results are as follows: heart rates range from 150 to 273 beats per minute, averaging 215 + or - 6 beats per minute. Conduction speed from pace-marker to ventricle in the monkey heart decreases linearly with increase in heart rate. Most electrical positions of monkey hearts were vertical or semi-vertical. The mean durations of P, QRS, and T waves taken with limb leads are 0.037 + or - 0.014, 0.037 + or - 0.014, and 0.07 + or - 0.004 sec, respectively. A shift of the ST strength was commonly found in the monkeys and appears to be related to their rapid heart rates. Author

N73-16063*# Linguistic Systems, Inc., Cambridge, Mass.
ON TABLE SALT FEVER
H. Freund Washington NASA Jan. 1973 21 p refs Transl. into ENGLISH from Arch. Exp. Pathol. Pharm. (Leipzig), v. 65, 1913 p 225-338
(Contract NASw-2482)
(NASA-TT-F-14677) Avail: NTIS HC $3.25 CSCL 06C

Table salt was administered intravenously to rabbits. Using as fever criteria a 0.8 C temperature rise, fever occured in 88% of the subjects. No immunity to this reaction developed. The fever can be suppressed by Ringer's solution, certain dietary factors, and narcotics. Adrenalin was found to produce analogous effects. Author

N73-16064*# National Aeronautics and Space Administration, Washington, D.C.
RESULTS OF THE 1971 CORN BLIGHT WATCH EXPERIMENT
Robert B. MacDonald, Richard D. Allen (Dept. of Agr.), Marvin E. Bauer (Purdue Univ.), Joseph W. Clifton (Dept. of Agr.), Jon D. Frickson (Mich. Univ.), and David A. Landgrebe (Purdue Univ.) Lafayette, Ind. Purdue Univ. [1972] 34 p refs Presented at 8th Intern. Symp. on Remote Sensing of Environment, Ann Arbor, Mich., 26 Oct. 1972 Prepared in cooperation with Purdue Univ., Lab. for Applications of Remote Sensing
(Grant NGL-15-005-112)

(NASA-TM-X-69055; LARS-Print-100272) Avail: NTIS HC $3.75 CSCL 02C

Advanced remote sensing techniques are used to: (1)Detect development and spread of corn leaf blight during the growing season; (2) assess the extent and severity of blight infection; (3) assess the impact of blight on corn production; and (4) estimate the applicability of these techniques to similar situations occurring in the future. Author

N73-16065*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

SPECTRAL CHARACTERISTICS OF NORMAL AND NUTRIENT-DEFICIENT MAIZE LEAVES

A. H. Al-Abbas, R. Barr, J. D. Hall, F. L. Crane, and M. F. Baumgardner Aug. 1972 22 p refs

(Grant NGL-15-005-112; Contract DA-12-14-100-10292(20); Grants NSF GB-5701; GM-K6-21839; GM-01392)

(NASA-CR-130032; LARS-Print-111472; J-Paper-4839) Avail: NTIS HC $3.25 CSCL 06F

Reflectance, transmittance and absorbence spectra of normal and six types of mineral-deficient (N,P,K,S,Mg and Ca) maize (Zea mays L.) leaves were analyzed at 30 selected wavelengths along the electromagnetic spectrum from 500 to 2600 nm. Chlorophyll content and percent leaf moisture were also determined. Leaf thermograms were obtained for normal, N- and S- deficient leaves. The results of the analysis of variance showed significant differences in reflectance, transmittance and absorbence in the visible wavelengths among leaf numbers 3, 4, and 5, among the seven nutrient treatments, and among the interactions of leaves and treatments. In the reflective infrared wavelengths only treatments produced significant differences. The chlorophyll content of leaves was reduced in all deficiencies in comparison to controls. Percent moisture was increased in S-, Mg- and N-deficiencies. Positive correlation ($r = 0.707$) between moisture content and percent absorption at both 1450 and 1930 nm were obtained. Polynomial regression analysis of leaf thickness and leaf moisture content showed that these two variables were significantly and directly related ($r = 0.894$). Author

N73-16066*# Union Carbide Research Inst., Tarrytown, N.Y. Environmental Physiology Lab.

PREDICTIVE MODELING OF ALTITUDE DECOMPRESSION SICKNESS IN HUMANS Final Report

David J. Kenyon, Robert W. Hamilton, Jr., Ian A. Colley, and Heinz R. Schreiner 19 Dec. 1972 39 p refs

(Contract NAS2-6697)

(NASA-CR-114550) Avail: NTIS HC $4.00 CSCL 06S

The coding of data on 2,565 individual human altitude chamber tests is reported as part of a selection procedure designed to eliminate individuals who are highly susceptible to decompression sickness, individual aircrew members were exposed to the pressure equivalent of 37,000 feet and observed for one hour. Many entries refer to subjects who have been tested two or three times. This data contains a substantial body of statistical information important to the understanding of the mechanisms of altitude decompression sickness and for the computation of improved high altitude operating procedures. Appropriate computer formats and encoding procedures were developed and all 2,565 entries have been converted to these formats and stored on magnetic tape. A gas loading file was produced. Author

N73-16067*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A HIGH YIELD NEUTRON TARGET FOR CANCER THERAPY

Donald L. Alger and Robert Steinberg 1972 9 p refs Presented at Conf. on Nucl. Instrumentation for Res. and Develop., Miami Beach, Fla., 6-8 Dec. 1972

(NASA-TM-X-68179; E-7271) Avail: NTIS HC $3.00 CSCL 06E

A rotating target was developed that has the potential for providing an initial yield of 10 to the 13th power neutrons per second by the T(d,n)He-4 reaction, and a useable lifetime in excess of 600 hours. This yield and lifetime are indicated for a 300 Kv and 30 mA deuteron accelerator and a 30 microns thick titanium tritide film formed of the stoichiometric compound TiT2. The potential for extended lifetime is made possible by incorporating a sputtering electrode that permits use of titanium tritide thicknesses much greater than the deuteron range. The electrode is used to remove in situ depleted titanium layers to expose fresh tritide beneath. The utilization of the rotating target as a source of fast neutrons for cancer therapy is discussed. Author

N73-16068# Joint Publications Research Service, Arlington, Va.

RHYTHM OF SLEEP AND WAKEFULNESS IN CREWS OF THE SPACESHIPS SOYUZ 3-9 BEFORE, DURING AND AFTER EXPOSURE TO SPACEFLIGHT

A. N. Litsov 7 Feb. 1973 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (USSR), no. 6, 1972 p 836-845

(JPRS-58173) Avail: NTIS HC $3.00 CSCL 06P

Data on the work and rest regimes of crew members of the Soyuz 3 to 9 spaceships in the course of preparations for and implementation of space flight are presented. Author

N73-16069# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.

ANNUAL REPORT FOR 1971 TO THE USAEC DIVISION OF BIOLOGY AND MEDICINE. VOLUME 2: PHYSICAL SCIENCES. PART 2: RADIOLOGICAL SCIENCES

J. M. Nielsen May 1972 117 p refs

(Contract AT(45-1)-1830)

(BNWL-1651-Vol-2-Pt-2) Avail: NTIS

Brief summaries are presented of work done in the fields of environmental and radiological chemistry, radiation instrumentation, radiation dosimetry, and radiation and health physics. Eighteen separate abstracts were prepared. NSA

N73-16070# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

THE EFFECTS OF HYPOXIA AND ACCELERATION ON ENZYME ACTIVITIES IN ERYTHROCYTES AND PLASMA Ph.D. Thesis - Bonn Univ. [DIE AUSWIRKUNG VON SAUERSTOFFMANGEL UND BESCHLEUNIGUNG AUF EINIGE ENZYMAKTIVITAETEN IM ERYTHROZYTEN UND IM PLASMA]

Ingo Carl Sep. 1972 45 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-71) Avail: NTIS HC $4.25; DFVLR Porz-Wahn: 13,80 DM

Eleven male subjects were exposed to hypoxia corresponding to an altitude of 6,900 meters and to acceleration of 2.5 + G sub z. Prior to stress and at certain intervals during and after it the number of erythrocytes, hematocrit, and plasma protein concentration were determined. Erythrocytes, hematocrit, and plasma protein increased under both conditions. Under hypoxia the activities of MDH and GOT increased significantly. Under acceleration only the activity of GOT. With the exception of the G-6-PHD activity, which showed a considerable increase under hypoxia, no significant changes could be observed in enzyme activities in erythrocytes under both stresses. Since there is no congruent reaction in the enzyme activities in erythrocytes and plasma, erythrocytes cannot be considered to be a main enzyme source for the plasma level in the ubiquitary cell enzymes. The different responses of the measured blood parameters to both stresses indicate a specific reaction which is dependent on the type of stress. Author (ESRO)

N73-16071# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

NMR SPECTROSCOPIC AND CALORIMETRIC INVESTIGATION OF RIBONUCLEASE A AND T1 [KMR-SPEKTROSKOPISCHE UND KALORIMETRISCHE UNTERSUCHUNG DER RIBONUKLEASE A UND DER RIBONUKLEASE T1]

H. Rueterjans Bonn Bundeswehramt 1972 160 p refs In GERMAN; ENGLISH summary Sponsored in part by Bundesmin. fuer Verteidigung, und Deut. Forschungsgemeinschaft

(BMVg-FBWT-72-7) Avail: NTIS HC $10.00; Bundeswehramt 25 DM

High resolution nuclear magnetic resonance spectroscopy and calorimetry was applied to ion interaction studies, inhibitors, and substrate analogics with two ribonucleases. The analyses of the

functions of histidine residues in the active sites of ribonucleases was found to be relatively easy, since the resonances of the C-2 protons of imidazole rings occur at a downfield range, well separated from all other signals. The chemical shifts of the C-2 proton resonance signals change as the imidazole ring is protonated or deprotonated, so that the pK values of the histidine residues can be measured in a direct manner. Author (ESRO)

N73-16072# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

ANTIDOTES FOR ALKYL PHOSPHATE POISONING: STRUCTURE-EFFECT RELATIONS IN VIVO AND IN VITRO [ANTIDOTE GEGEN ALKYLPHOSPHATVERGIFTUNGEN: STRUKTUR-WIRKUNGS-BEZIEHUNGEN IN VIVO UND IN VITRO]

H. Oldiges and K. Schoene Bonn Bundeswehramt 1972 47 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-72-8) Avail: NTIS HC $4.50; Bundeswehramt 25 DM

The protective effects of pyridinium salts were studied for Tabun and Sarin poisoning. The most suitable reactivator for antidote treatment of an alkyl phosphate poisoning is selected. Aging tests were conducted in vitro, with the result of an aging delay in vivo effective substances. The titration of acetyl cholinesterase with Soman is described. The reactivation/rephosphorylation equilibrium and the decay of the phosphyOrloximes were kinetically analyzed. Author (ESRO)

N73-16073# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

CALORIMETRIC INVESTIGATION OF ENZYMES. THERMODYNAMIC PARAMETER DETERMINATION OF THE INTERACTION BETWEEN RIBONUCLEASE T1 INHIBITORS AND SUBSTRATES [KALORIMETRISCHE UNTERSUCHUNGEN AN ENZYMEN. DIE BESTIMMUNG THERMODYNAMISCHER PARAMETER DER WECHSELWIRKUNG VON RIBONUKLEASE T1 MIT INHIBITOREN UND SUBSTRATEN]

W. Maurer, W. Haar, and H. Rueterjans Bonn Bundeswehramt 1972 35 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(FMVg-FBWT-72-12) Avail: NTIS HC $3.75; Bundeswehramt 25 DM

The enthalpy values were measured for the reaction of several retarding mononucleotides with ribonuclease T1. The thermodynamic parameters for enzyme-inhibitor interactions were obtained from direct calorimetric measurements. The nucleotides were joined to substrates and the order of the retarding effect is described. The thermodynamic parameters were determined for several ph values. Author (ESRO)

N73-16074# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

NUCLEAR RESONANCE INVESTIGATION OF ENZYMES. PMR SPECTRA OF RIBONUCLEASE INHIBITOR COMPLEXES [KERNRESONANZUNTERSUCHUNGEN AN ENZYMEN. PMR-SPEKTREN VON RIBONUKLEASE-INHIBITOR-KOMPLEXEN]

W. Maurer, W. Haar, and H. Rueterjans Bonn Bundeswehramt 1972 46 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-72-13) Avail: NTIS HC $4.50; Bundeswehramt 25 DM

The proton magnetic resonance spectra of ribonuclease A enzyme-inhibitor complexes with nucleotides were studied. From the observed changes in the chemical shifts of histidine and base protons, it was possible to evaluate some aspects of the spatial arrangement of the amino acid side chains, and the conformation of the inhibitors in the active site. The results are discussed with regard to catalytic action. Author (ESRO)

N73-16075# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

PHARMACOLOGICAL INVESTIGATION OF THE PARASYMPATHOLYTICAL EFFECT OF MONO AND BISQUATERNARY PYRIDINIUM COMPOUNDS ON THE ISOLATED GUINEA PIG ILEUM [PHARMAKOLOGISCHE UNTERSUCHUNGEN UEBER DEN MECHANISMUS DER PARASYMPATHOLYTISCHEN WIRKUNG MONO- UND BISQUARTAERER PYRIDINIUMVERBIDUNGEN AUF DAS ISOLIERTE ILEUM DES MEERSCHWEINCHENS]

D. Kuhnen-Clausen Bonn Bundeswehramt 1972 43 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-72-14) Avail: NTIS HC $4.25; Bundeswehramt 25 DM

The antagonistic effects were investigated in mono- and bisquaternary pyridium compounds on muscarinic agonists of the isolated guinea pig ileum. The influence of the experimental technique, the incubation time, and the receptor reserve were analyzed. The compounds have parasympatholytic, antimuscarinic effects. The affinity to the receptor is greater in presence of 4 pyridinium aldoxime-substituted than that of unsubstituted, 2-isomer or nicotinamide compounds. The molecular pharmacological mechanism of the antagonistic action of the compounds is discussed. Author (ESRO)

N73-16076# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

SKIN PROTECTION AGAINST HIGH TOXIC PHOSPHORIC ACID ESTERS [UNTERSUCHUNGEN ZU EINEM HAUTSCHUTZ GEGENUEBER HOCHTOXISCHEN PHOSPHORSAEURE-ESTERN]

G. Schreiber Bonn Bundeswehramt 1972 55 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-72-15) Avail: NTIS HC $4.75; Bundeswehramt 25 DM

The penetration of a highly toxic alkyl phosphate (diisopropyl fluoro phosphate), DFP, 10% w/v in n-tripropyl phosphate through unprotected and coated pig skin (with 23 barrier creams) was investigated in a penetration chamber. The drug was detected enzymatically (cholinesterase inhibition). The comparative study showed inhibited skin penetration of the drug for 14 of the barrier creams and increased penetration for 9. Materials, methods, and results are discussed. Further development of an improved barrier cream against highly toxic alkyl phosphates is suggested. Author (ESRO)

N73-16077# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

BIOLOGICAL EFFECTS OF FAST NEUTRONS. MORTALITY AND CHANGES IN BLOOD CELL COUNT OF MICE AFTER COMPLETE EXPOSURE TO FAST NEUTRONS AND X-RAYS [BIOLOGISCHE WIRKUNG SCHNELLER NEUTRONEN. MORTALITAET UND VERAENDERUNGEN IM BLUTBILD VON MAEUSEN NACH GANSKOERPERBESTRAHLUNG MIT SCHNELLEN NEUTRONEN UND ROENTGENSTRAHLEN]

F. J. Otto Bonn Bundeswehramt 1972 34 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-72-16) Avail: NTIS HC $3.75; Bundeswehramt 25 DM

The biological effects of fast neutrons in the energy range 2 to 6 MeV were studied in mice and compared with the effects of X-rays. The total mortality after 30 days, the mortality patterns, and the changes in blood cell count were examined. After neutron irradiation death occurs earlier and the variations in death time are greater than after X-irradiation. The decrease of lymphocyte number 48 hours after irradiation shows a linear relation to dose logarithm. Lymphocyte number as a measure of radiation damage is found to be reliable and useful over a wide dose range. The relative biological effectiveness of neutrons in lymphocyte decrease is 2.0 after low doses and 1.4 after high doses. The number of reticulocytes decreases 48 hours after neutron irradiation. ESRO

N73-16078# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

THE ACUTE TOXICITY OF CHLORINE PENTAFLUORIDE
Kenneth I Darmer, Jr. Dec. 1971 12 p refs Presented at 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; sponsored by the SysteMed Corp., Dayton, Ohio
(AF Proj. 6302)
(AD-751452; AMRL-TR-71-120-Paper-21) Avail: NTIS CSCL 06/20

The present study was undertaken to obtain symptomatic and pathological information resulting from acute exposure to ClF5 gas, and to determine the LC(50) values for exposure of rats, mice, dogs, and monkeys for 15, 30, and 60 minutes.
GRA

N73-16079# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE TOXICOLOGY OF SOME COMMERCIAL FLUOROCARBONS
Richard S. Waritz Dec. 1971 17 p refs Presented at 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; sponsored by SysteMed Corp.
(AF Proj. 6302)
(AD-751429; AMRL-TR-71-120-Paper-7) Avail: NTIS CSCL 06/2

The field of fluorocarbon toxicology is a very fascinating toxicological area. Except for the field of natural products such as amino acids and carbohydrates, it contains some of the best examples of extreme variations of biological activity accompanying seemingly minor structural variations. The report discusses these variations and the toxicology of various compounds. GRA

N73-16080# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE TOXICITY OF PYROLYSIS PRODUCTS FROM A CHLOROTRIFLUOROETYHYLENE-ETHYLENE COPOLYMER (HALAR RESIN)
Lester D. Scheel (PHS, Cincinnati), A. B. Robertson (Allied Chem. Corp., Morristown, N. J.), Richard E. Kupel (PHS, Cincinnati), Charles V. Cooper (PHS, Cincinnati), William P. Tolos (PHS, Cincinnati), Louis Vignati (PHS, Cincinnati), and Donald E. Richards (PHS, Cincinnati) Dec. 1971 27 p refs Presented at Ann. Conf. on Environ. Toxicol. (2d), Fairborn, Ohio, 31 Aug. and 1-2 Sep. 1971; sponsored by SysteMed Corp.
(AD-751436; AMRL-TR-71-120-Paper-14) Avail: NTIS CSCL 06/20

Halar (Trademark of the Allied Chemical Corporation), a new copolymer of chlorotrifluoroethylene (CTFE) and ethylene having a 50/50 mole ratio and a high degree of one-to-one alternation, offers an attractive combination of properties. The structure elucidation of poly CTFE-E is described. The products formed when poly CTFE-E undergoes the inhalation of those pyrolysis products have also been studied. GRA

N73-16081# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
DICHLOROMETHANE HEPATOTOXICITY IN MICE WITH CONTINUOUS AND INTERMITTENT INHALATION EXPOSURES
Ronald S. Weinstein, Dale D. Boyd, and Kenneth C. Back Dec. 1971 40 p refs Presented at 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; sponsored by SysteMed Corp.
(AF Proj. 6302)
(AD-751434; AMRL-TR-71-120-Paper-12) Avail: NTIS CSCL 06/20

Few guidelines exist for establishing acceptable exposure levels for continuous exposures to toxic substances on the basis of data obtained from single or intermittent exposure experiments. In this study, the effects of continuous inhalation of CH2Cl2 on mice were examined in detail with respect to liver changes. The effects of continuous CH2Cl2 exposures are of particular interest since CH2Cl2 is present in space cabin construction materials and may be present in trace amounts in the atmosphere of space cabins. A comparison of the effects produced by continuous exposure with those of intermittent exposures should help in extrapolating and predicting effects and results of continuous exposures from data on intermittent exposures.
GRA

N73-16082# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EFFECTS OF METHYLENE CHLORIDE EXPOSURE ON THE SPONTANEOUS ACTIVITY OF MICE
Anthony A. Thomas, Mildred K. Pinkerton, and James A. Warden Dec. 1971 7 p ref Presented at 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; sponsored by SysteMed Corp.
(AF Proj. 6302)
(AD-751435; AMRL-TR-71-120-Paper-13) Avail: NTIS CSCL 06/20

The experiments described were conducted during continuous exposure of mice to methylene chloride (dichloromethane). The group exposed to 5000 ppm methylene chloride was severely affected and by the seventh day 50% of the mice died. The 1000 ppm exposed group survived the entire four weeks and the spontaneous activity findings are presented. Results indicate that there is a definite trend toward lower activity during exposure, and when one compares the first two-week exposure period with the second two-week exposure period, activity seems to be stabilized at a considerably lower level. GRA

N73-16083# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PATHOLOGICAL LESIONS CAUSED BY METHYLISOBUTYLKETONE
William F. MacKenzie Dec. 1971 14 p refs Presented at 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; sponsored by SysteMed Corp.
(AF Proj. 6302)
(AD-751444; AMRL-TR-71-120-Paper-23) Avail: NTIS CSCL 06/20

The lesions caused by methylisobutylketone (MIBK) were interesting in that they were found only in one species, the rat, and in that species were limited to a specific part on one organ - the first and second sections of the proximal convoluted tubule of the nephron of the kidney. This lesion was designated hyaline droplet toxic tubular nephrosis, although in some respects it differed from the classic concept of hyaline droplet formation. The lesion was present at 14 days of exposure and continued with a variable decrease in severity throughout the exposure. In those rats removed for serial sacrifice at weekly intervals from the second week to the end of the exposure, the lesion completely reversed between the third and fourth weeks postexposure.
GRA

N73-16084# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
GUIDES FOR SHORT-TERM EXPOSURES OF THE PUBLIC TO AIR POLLUTANTS
Frank G. Favorite, Lawrence M. Roslinski, and Ralph C. Wands Dec. 1971 7 p ref Presented at 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; sponsored by SysteMed Corp.
(AF-6302)
(AD-751438; AMRL-TR-71-120-Paper-16) Avail: NTIS CSCL 13/2

The short-term exposure limits for three air pollutants - nitrogen oxides, hydrogen chloride, and hydrogen fluoride - as determined by the National Academy of Sciences, are presented. GRA

N73-16085# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE ACUTE TOXICITY OF BRIEF EXPOSURES TO HYDROGEN FLUORIDE, HYRDROGEN CHLORIDE, NITROGEN DIOXIDE, AND HYDROGEN CYANIDE SINGLY AND IN COMBINATION WITH CARBON MONOXIDE
L. C. DiPasquale and H. V. Davis (Standard Oil of Ill., Chicago) Dec. 1971 14 p refs Presented at the 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; sponsored by SysteMed Corp., Dayton, Ohio
(AD-751442; AMRL-TR-71-120-Paper-20) Avail: NTIS CSCL 06/20

Many of the common plastic and rubber formulations in widespread use as aircraft cabin materials represent potential hazards in the event of fire aboard an aircraft. For example, polyurethane foams contain diisocyanate, fluorinated and

chlorinated hydrocarbons, in addition to various aliphatic amines. When subjected to the high temperatures of combustion, the pyro-decomposition products formed would include hydrogen chloride (HCl), hydrogen fluoride (HF), hydrogen cyanide (HCN), and nitrogen dioxide (NO2) gases. Because of the inadequacy of available information regarding toxicity of these gases under very brief exposure conditions, animal experiments were conducted using these compounds, both singly and in combination with carbon monoxide (CO), to determine five-minute LC(50) values. It was important to see just what, if any, effect the (CO) would have on the toxicity of these several compounds. GRA

N73-16086# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

ANIMAL PATHOLOGY RESULTING FROM LONG TERM EXPOSURE TO LOW LEVELS OF MONOMETHYLHYDRAZINE

D. J. Kroe Dec. 1971 10 p. refs Presented at 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; sponsored by SysteMed Corp.

(AF Proj. 6302)

(AD-751441; AMRL-TR-71-120-Paper-19) Avail: NTIS CSCL 06/20

The present experiments were designed to pursue investigation of the toxic effects of intermittent or continuous chronic exposure of monkeys, dogs, rats, and mice to lower levels of environmental MMH. These experiments demonstrated that continuous exposure of monkeys or rats at a concentration of 0.2 ppm MMH does not induce histopathological lesions at the light microscopic level. The same exposure levels and exposure periods do induce pathological lesions in livers and kidneys of dogs and livers, kidneys, and spleens of mice. Mice show hepatic, splenic, and renal tubular hemosiderosis under all conditions of exposure to MMH; however, the degree of hemosiderosis shows a dose related pattern. The fact that the MMH exposure conditions of these experiments induce histopathological changes in dogs and mice but not in monkeys and rats is most probably explained by species susceptibility to MMH induced hemolysis and species capability for clearing the products of hemolysis. Lymphoid hyperplasia was noted in some exposed dogs; however, the limited sampling precludes definitive interpretation of this observation. The present experiments do not indicate a zero-toxicity MMH exposure level for dogs and mice. The experiments do demonstrate a striking difference in species susceptibility to MMH toxicity, and indicate tissue zero-toxicity levels for monkeys and rats as evaluated by light microscopy. GRA

N73-16087# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

CHRONIC EXPOSURE STUDIES WITH MONOMETHYLHYDRAZINE

J. D. MacEwen and C. C. Haun Dec. 1971 18 p refs Presented at the 2nd Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971, sponsored by SysteMed Corp.

(AD-751440; AMRL-TR-71-120-Paper-18) Avail: NTIS CSCL 06/20

The manufacture and use of monomethylhydrazine (MMH) as a rocket fuel has increased over the past 10 years. The acute health hazards from handling this highly reactive compound are well defined, but although its usage is increasing little is known about its chronic exposure effects. The current industrial threshold limit value (TLV) of 0.2 ppm was established by analogy with hydrazine and unsymmetrical dimethylhydrazine. A series of 6-month MMH chronic exposures to four animal species was undertaken to evaluate the safety factor and appropriateness of the current TLV for health of workmen. The results of these experiments showed that MMH produces a dose-related hemolytic anemia with Heinz body formation for which there appears to be no threshold effect level. The anemia is reversible with removal from further exposure at least up to a level of 5 ppm intermittent exposure. For use in establishing continuous exposure limits for confined spaces such as missile silos, consideration should be given to variations in concentration which could considerably shift the exposed people down the effect curve. Consideration should also be given to the effect of MMH on people with preexisting blood dyscrasias or hemolytic traits. GRA

N73-16088# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

BASIS FOR ESTABLISHING GUIDES FOR SHORT TERM EXPOSURE OF THE PUBLIC TO AIR POLLUTANTS

Ralph C. Wands, Frank G. Favorite, and Lawrence M. Roslinski Dec. 1971 8 p refs Presented at the 2nd Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug., 2 Sep. 1971; sponsored by SysteMed Corp., Dayton Ohio

(AD-751437; AMRL-TR-71-120-Paper-15) Avail: NTIS CSCL 13/2

The report describes the work of the Committee on Toxicology of the National Research Council in setting up short term exposure limits for air pollutants. GRA

N73-16089# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

CARDIOPULMONARY EFFECTS OF FLUOROCARBON COMPOUNDS

Domingo M. Aviado Dec. 1971 11 p refs Presented at 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; sponsored by SysteMed Corp.

(AF Proj. 6302)

(AD-751426; AMRL-TR-71-120-Paper-4) Avail: NTIS CSCL 06/20

The present investigation was designed to examine the hypothesis that the cardiopulmonary toxicity of the propellants is related to the irritation of sensory receptors in the respiratory passages. The anesthetized dog was used to allow measurement of pulmonary resistance and compliance, when propellants were confined to the upper respiratory tract or were administered intratracheally, bypassing the upper respiratory tract. Additional procedures to determine whether propellants influence the bronchial smooth muscle, pulmonary blood vessels and the heart are reported. Three propellants commonly used in aerosol units containing bronchodilators were investigated. They are trichlorofluoromethane (propellant 11), dichlorodifluoromethane (propellant 12), and 1,2-dichloro-1,1,2,2-tetrafluoroethane (propellant 114). GRA

N73-16090# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

CARDIAC TOXICITY OF AEROSOL PROPELLANTS

Willard S. Harris Dec. 1971 10 p refs Presented at 2d Ann. Conf. Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; sponsored by SysteMed Corp.

(AF Proj. 6302)

(AD-751425; AMRL-TR-71-120-Paper-3) Avail: NTIS CSCL 06/20

The fluoroalkane gases used to propel aerosols sensitize the hearts of mice to asphyxia-induced sinus bradycardia, atrioventricular block and T-wave depression, quickly enter the blood of monkeys, cats and dogs after inhalation and, despite adequate oxygenation, have a spectrum of cardiovascular toxic effects; for example, directly depressing contractility in rat, cat, dog and human myocardium and rapidly inducing ventricular arrhythmias in awake or anesthetized monkeys. The relevance of these findings to sudden unexpected death in young people who deliberately inhale these gases, to the widespread use of household and cosmetic aerosols, which most commonly discharge as propellants, Freons 12, 11 and 114, and perhaps, to the increasing uses of other Freons (e.g., the solvent, Freon 113), makes deeper study of this toxicity mandatory. Author (GRA)

N73-16091# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

CARDIOVASCULAR EFFECTS OF FLUOROCARBON EXPOSURE

Alex Azar (Du Pont de Nemours (E. I.) and Co., Wilmington, Del.) Dec. 1971 31 p refs Presented at 2nd Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; sponsored by SysteMed Corp.

(AF Proj. 6302)

(AD-751427; AMRL-TR-71-120-Paper-5) Avail: NTIS CSCL 06/20

The report reviews studies which have shown that certain fluorinated hydrocarbon compounds are capable of sensitizing the mammalian heart to epinephrine resulting in serious cardiac

arrhythmias. This phenomenon is referred to as cardiac sensitization. GRA

N73-16092# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EFFECTS OF MONOMETHYLHYDRAZINE ON BLOOD AND CEREBROSPINAL FLUID GLUCOSE IN ANESTHETIZED MONKEYS
Bennett A. Shaywitz, William T. Gormley, Marilyn E. George, and Kenneth C. Back Jun. 1972 18 p refs
(AF Proj. 6302)
(AD-751232; AMRL-TR-71-122) Avail: NTIS CSCL 06/20

Plasma and CSF glucose was investigated in fasted, pentobarital anesthetized rhesus monkeys given monomethylhydrazine (MMH) 25 mg/kg i.v. Glucose was determined by the glucose oxidase method. Fasting blood glucose and CSF glucose in mg % averaged 48.8 plus or minus 2.5 (S.E.) and 45.1 plus or minus 2.9 (S.E.) respectively. The CSF/blood ratio of 0.923 is similar to that reported for dogs but differs from the ratio of 0.6 for humans. Following MMH, both blood and CSF glucose increased to 90.6 plus or minus 8.0 and 63.8 plus or minus 5.5 mg % respectively and the CSF/blood ratio decreased to 0.704. Formation of CSF averaged 0.028 and 0.035 ml/min before and after MMH respectively. Convulsions occurred in half the monkeys 120 minutes after MMH, a time when both blood and CSF glucose were elevated. Author (GRA)

N73-16396* Geological Survey, Washington, D.C.
APPLICATION OF REMOTE SENSING TECHNIQUES FOR APPRAISING CHANGES IN WILDLIFE HABITAT
Harvey K. Nelson (Northern Prairie Wildlife Res. Center), A. T. Klett (Northern Prairie Wildlife Res. Center), and John E. Johnston *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 260-288 refs (For availability see N73-16382 07-13)
CSCL 02E

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-16093*# Southwest Research Inst., San Antonio, Tex. Biomedical Applications Team.
SOUTHWEST RESEARCH INSTITUTE ASSISTANCE TO NASA IN BIOMEDICAL AREAS OF THE TECHNOLOGY UTILIZATION PROGRAM Monthly Report, 1-31 Dec. 1972
31 Dec. 1972 84 p refs
(Contract NASw-1867; SwRI Proj. 13-2538)
(NASA-CR-130022) Avail: NTIS HC $6.25 CSCL 06B

The problem statements presented relate mostly to research on prosthetic equipment and means of attaching biomedical and electronic devices to the human body. A patent application for a reliable switching element in a patient assist control unit is also described. G.G.

N73-16094*# AiResearch Mfg. Co., Los Angeles, Calif.
TEKTITE 2 HABITABILITY RESEARCH PROGRAM: DAY-TO-DAY LIFE IN THE HABITAT
D. P. Nowlis 30 Mar. 1972 130 p
(Contract NAS8-25100)
(NASA-CR-130034; Rept-71-6192-2) Avail: NTIS HC $8.50 CSCL 05E

Because it is widely agreed that the field of environmental psychology is quite young, it was determined that a sample of recorded observations from a representative mission should be included in the report on Tektite to give the professional reader a better feeling of normal day-to-day life in the isolated habitat. Names of the crew members have been replaced with numbers and some off-color words have been replaced by more acceptable slang; some remarks have been omitted that might lead to easy identification of the subjects. Otherwise, the following pages are exactly as transcribed during the late afternoons and the evenings of the mission. Author

N73-16095*# Geoscience, Ltd., Solana Beach, Calif.
A URINE VOLUME MEASUREMENT SYSTEM Final Report, 29 Apr. 1971 - 31 Dec. 1972
H. F. Poppendiek, G. Mouritzen, and C. M. Sabin Dec. 1972 47 p refs
(Contract NAS9-11612)
(NASA-CR-128726; GLR-113) Avail: NTIS HC $4.50 CSCL 06B

An improved urine volume measurement system for use in the unusual environment of manned space flight is reported. The system utilizes a low time-constant thermal flowmeter. The time integral of the transient response of the flowmeter gives the urine volume during a void as it occurs. In addition, the two phase flows through the flowmeter present no problem. Developments of the thermal flowmeter and a verification of the predicted performance characteristics are summarized. Author

N73-16096*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AUTOMATIC INOCULATING APPARATUS Patent Application
Judd R. Wilkins and Stacey M. Mills, inventors (to NASA) Filed 24 Jan. 1973 19 p
(NASA-Case-LAR-11074-1; US-Patent-Appl-SN-326364) Avail: NTIS HC $3.00 CSCL 06B

An automatic inoculating apparatus for agar trays is reported that uses a simple inoculating element such as a cotton swab or inoculating loop. The apparatus includes a movable carriage for supporting the tray to be inoculated, a drive motor for moving the tray along a trackway and a swabbing motor for automatically swabbing the tray during movement. An actuator motor controls lowering and lifting of the inoculating element. An electrical control system including limit microswitches enables automatic control of the actuator motor and return of the carriage to the initial position after inoculating is completed. NASA

N73-16097*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A METHOD FOR DEFINING DOWN-WIND EVACUATION AREAS FOR TRANSPORTATION ACCIDENTS INVOLVING TOXIC PROPELLANT SPILLS
R. D. Siewert 1972 15 p refs Presented at 1972 Joint Army Navy NASA AF (JANNAF) Prop. Meeting, New Orleans, La., 27-29 Nov. 1972
(NASA-TM-X-68188; E-7320) Avail: NTIS HC $3.00 CSCL 13B

Evacuation areas for accidental spills of toxic propellants along rail and highway shipping routes are defined to help local authorities reduce risks to people from excessive vapor concentrations. These criteria along with other emergency information are shown in propellant spill cards. The evacuation areas are based on current best estimates of propellant evaporation rates from various areas of spill puddles. These rates are used together with a continuous point-source, bi-normal model of plume dispersion. The rate at which the toxic plume disperses is based on a neutral atmospheric condition. This condition, which results in slow plume dispersion, represents the widest range of weather parameters which could occur during the day and nighttime periods. Evacuation areas are defined by the ground level boundaries of the plume within which the concentrations exceed the toxic Threshold Limit Value (TLV) or in some cases the Emergency Exposure Limit (EEL). Author

N73-16098# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF HANDEDNESS ON A TRACKING TASK
R. V. Wilson Aug. 1972 26 p refs
(RAE-TR-72117; BR-31173) Avail: NTIS HC $3.50

Eight male right-handed subjects performed a total of twelve 3-minute runs on a compensatory tracking task. The subjects were divided into two groups matched for handedness. One group performed the first six runs with the preferred (right) hand while the other group used the non-preferred (left) hand. For the remaining six runs the two groups used their other hand. No significant differences were found between performance with the two hands. Performance with the hand utilized in the second half of the experiment was significantly better than that used in

the first half. The results of the experiment are further examined in terms of the learning phenomena normally associated with the acquisition of psychomotor skills. The absence of both unilateral and bilateral reminiscence effects is discussed.
Author (ESRO)

N73-16099# Royal Aircraft Establishment, Farnborough (England).
A PROJECTED GRID METHOD FOR RECORDING THE SHAPE OF THE HUMAN FACE
J. Cobb Mar. 1972 33 p refs
(RAE-TR-71184; BR-28791) Avail: NTIS HC $3.75

The work carried out to design equipment is described which would quickly and cheaply record the shapes of a large number of human faces. It is intended for use in an anthropometric survey with a view to providing data for a project aimed at improving the fit and comfort of oxygen masks for service use. The data is examined to discover a parameter of the human face which can be used to determine which mask size is best suited to any individual. A simple, quick, and adequately accurate equipment for recording one side of the face was developed from an earlier design and includes several refinements to simplify the analysis. The survey will assume that the mean aircrew face is symmetrical although it is realized that individual faces are not. The accuracy of the equipment was measured and is within the required one millimeter.
Author (ESRO)

N73-16100# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE TRANSMISSION OF TRIAXIAL VIBRATION TO PILOTS IN THE SCOUT AH Mkl HELICOPTER
M. J. Griffin Aug. 1972 82 p refs
(ISVR-TR-58) Avail: NTIS HC $6.25

Three experiments designed to determine the triaxial vibration experienced by pilots in the P-531 (Scout) helicopter are described. In the first experiment, eight Scout helicopters were flown by the same pilot in seven different flight conditions. In each condition, the mean and range of floor vibration were determined at frequencies of maximum vibration for each of three perpendicular axes. In the other two experiments, eight pilots flew in a single Scout helicopter with known floor vibration characteristics. The spectra of triaxial head vibration during four flight conditions were determined from trial two. In trial three, vertical vibration at the heads and at the interface between their bodies and the seat cushion were determined during the hover. The vibration data obtained from the three experiments are presented together with detailed consideration of the differences in vibration level associated with the different flight conditions, vibration axes, helicopters, and pilots.
Author (ESRO)

N73-16101# Bunker-Ramo Corp., Westlake Village, Calif. Electronic Systems Div.
TRAINING EFFECTIVENESS EVALUATION OF NAVAL TRAINING DEVICES. PART 1: A STUDY OF THE EFFECTIVENESS OF A CARRIER AIR TRAFFIC CONTROL CENTER TRAINING DEVICE Final Report, Jun. 1970 - Apr. 1971
Dorothy L. Finley, Thomas W. Rheinlander, Ernest A. Thompson, and Dennis J. Sullivan Aug. 1972 116 p refs
(Contract N61339-70-C-0258)
(AD-751556; NAVTRADEVCEN-70-C-0258-1-Pt-1) Avail: NTIS CSCL 05/9

The study evaluated the effectiveness of the Carrier Air Traffic Control Center (CATCC) training device in training teams to safely and efficiently control aircraft recoveries and to effectively maintain communications necessary to implement this control function. The results indicate the device is quite effective in that team, subteam, and individual performances generally improve during training, that student capability to deal with recovery contingencies and emergencies improves, that students generally perform acceptably in the operational job setting, that empirical evidence supports (but does not prove due to the study design) the transfer of training hypothesis, and that students gave the device moderate to high ratings on realism and effectiveness characteristics. It was concluded that device effectiveness could be further improved and that recommendations were worth consideration due to the considerable impact CATCC has on the efficiency and safety of carrier recovery operations.
Author (GRA)

N73-16102# School of Aerospace Medicine, Brooks AFB, Tex.
HUMAN FACTORS EVALUATION OF LASER PROTECTIVE VISORS Final Report, May 1971 - May 1972
William R. Thursby, Jr., Robert G. Braun, and Albert V. Alder Sep. 1972 16 p refs
(AD-751470; SAM-TR-72-23) Avail: NTIS CSCL 06/17

Three laser protective visors and a spectacle-goggle were evaluated by over 100 experienced, rated aircrew members under flight and simulated flight conditons to determine if use of such protective filters would unduly degrade performance of flying duties. Two of the visors and the spectacle-goggle were multiwavelength protective devices. The orange and blue visors provided multiwavelength protection for complementary parts of the near ultraviolet, visible, and the near infrared portions of the electromagnetic spectrum, and the spectacle-goggle essentially combined the protective capability of these visors into one unit. The yellow visor afforded protection specifically against neodymium laser light.
Author (GRA)

N73-16103# Air Force Human Resources Lab., Brooks AFB, Tex. Advanced Systems Div.
EVALUATION OF A DEVICE TO TRAIN FORWARD AIR CONTROLLERS TO COMMUNICATE TARGET LOCATIONS Final Report, 1 Aug. 1971 - 15 Mar. 1972
Horace H. Valverde, William J. Woods (Air Ground Operations School, Hurlburt Field, Fla.), and Ned H. Kearns (Systems Res. Labs., Inc., Dayton, Ohio) May 1972 56 p refs
(AF Proj. 1710)
(AD-751292; AFHRL-TR-72-12) Avail: NTIS CSCL 05/9

The report describes the development and evaluation of a forward air controller (FAC) and tactical strike pilot (TAC) trainer. The trainer was designed to permit a FAC and a TAC to practice the tasks of communicating the location of targets. A previous analysis of communications between FAC and TAC personnel during actual combat had revealed that the task of verbalizing imagery (describing what one is seeing) was especially difficult and important to the success of the FAC/TAC mission. Subjects for the evaluation consisted of 35 Air Force pilots selected to be trained as forward air controllers at Hurlburt Field, Florida.
Author (GRA)

N73-16104# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
THE DESIGN OF ANALYSIS OF A HUMAN BODY MOTION MEASUREMENT SYSTEM
L. Jack Little Sep. 1972 94 p refs
(DA Proj. 1X2-22251-D-231)
(AD-751134; RG-TR-72-19) Avail: NTIS CSCL 05/5

No adequate systems were found in a literature search that would permit direct measurement of human body segments' angular acceleration and muscle forces related to these accelerations which would allow application of analytic mechanics to the human motion problem. Therefore, a new system was designed and analyzed to provide accurate measurement of the body segments' motion directly by use of angular accelerometers. The basic elements of the system are the accelerometers, all electromyogram sensors, and a proportional bandwidth telemetry system that allows the human performer to move about freely. Verification of the system was accomplished by measurement of angular accelerations of the arm and leg links during kip-up maneuvers. Alignment of the accelerometers was achieved by an optical laser technique. The acceleration signals, stored on magnetic tape, were subsequently integrated to get rate and position in an inertial reference frame. These position data, obtained through integration, proved to be insufficiently accurate when compared with synchronized position data obtained from high speed motion picture film data.
Author (GRA)

N73-16105# Florida Univ., Gainesville. Dept. of Electrical Engineering.
QUANTITATIVE ANALYSIS OF THE PHYSIOLOGICAL CONDITION AND LEVEL OF ALERTNESS OF MAN IN AN ISOLATED ENVIRONMENT Annual Report
Jack R. Smith 2 Nov. 1972 6 p
(Grant AF-AFOSR-2171-72; AF Proj. 9777)

(AD-751272; AFOSR-72-2058TR) Avail: NTIS CSCL 05/10

The report discusses the design and fabrication of the electronic detectors necessary for analyzing an animal EEG and the software for computer processing of the data. Although analysis of human EEG's is not completed, it has been noted that monitoring the high frequencies present in the frontal channels provides a good indicator of whether or not the subject is awake. The activity appears to provide a more sensitive indicator of alertness than does alpha activity. Author (GRA)

N73-16052 Joint Publications Research Service, Arlington, Va.
REGULATION OF VERTICAL POSTURE AFTER FLIGHT ON THE SOYUZ-6 - SOYUZ-8 SHIPS AND 120 DAY HYPOKINESIA
Yu. N. Purakhin, L. I. Kakurin, V. S. Georgiyevskiy, B. N. Petukhov, and V. M. Mikhaylov *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 74-82 refs (For availability see N73-16041 07-04)

N73-16054 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF SOME MECHANISMS OF MAN'S TOLERANCE TO LOWER BODY DECOMPRESSION
P. M. Suvorov and R. V. Beleda *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 88-93 refs (For availability see N73-16041 07-04)

N73-16056 Joint Publications Research Service, Arlington, Va.
DIURNAL DYNAMICS OF PSYCHIC PERFORMANCE DURING 72 HOUR CONTINUOUS WAKEFULNESS
A. L. Narinskaya *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 101-108 refs (For availability see N73-16041 07-04)

N73-16058 Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF THE EFFECT OF HIGH MOUNTAIN ALPINISM EXERCISES ON THE HUMAN BODY
G. R. Rung *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 118-128 refs (For availability see N73-16041 07-04)

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-16106* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF DETECTING OXYGEN IN A GAS Patent
Herbert D. Hendricks, inventor (to NASA) Issued 9 Jan. 1973 5 p Filed 17 Aug. 1971 Supersedes N72-21103 (10-12, p 1567)
(NASA-Case-LAR-10668-1; US-Patent-3,709,663; US-Patent-Appl-SN-172459; US-Patent-Class-23-232R; US-Patent-Class-23-232E; US-Patent-Class-23-254R; US-Patent-Class-23-254E; US-Patent-Class-250-71R; US-Patent-Class-250-83.3UV) Avail: US Patent Office CSCL 07D

The presence of oxygen in a gas is detected by contacting an article, such as a film, comprising poly(ethylenenaphthalenedicarboxylate) with a gas and simultaneously exposing the article to ultraviolet light. The article is subsequently heated and the presence of oxygen in the gas is indicated by thermoluminescence. Offical Gazette of the U.S. Patent Office

N73-16107 Georgetown Univ., Washington, D.C.
THE LABORATORY ABSORPTION SPECTRUM OF NITROGEN PEROXIDE WITH SOLAR ILLUMINATION AND ITS APPLICATION TO A RECONSIDERATION OF THE EVIDENCE FOR NITROGEN PEROXIDE IN THE ATMOSPHERE OF MARS Ph.D. Thesis
Stephen Anthony Mango 1972 274 p
Avail: Univ. Microfilms Order No. 72-18306

A survey of the physical, chemical and optical properties of the nitrogen peroxide system under Martian conditions is presented. Microphotometer traces of high dispersion, laboratory absorption spectra of NO2 using solar illumination are presented for the regions (4180-5100 A) and (5890-6600 A) using NO2 pathlengths of 1.4 and 2.6 mm-atm (STP) respectively. A microphotometer trace of the solar spectrum is juxtaposed on the same grid of coordinates for comparison purposes. All of the microphotometer traces in this study were digitized and stored on magnetic tape. The digital sampling interval for both the laboratory and Martian spectra was approximately 0.005 A. The spectra were aligned, calibrated and reduced using an IBM 360-40 computer system and plotted by a CALCOMP 1627 plotter.
Dissert. Abstr.

N73-16108# Institut d'Aeronomie Spatiale de Belgique, Brussels.
MOLECULAR OXYGEN ABSORPTION IN THE SCHUMANN-RUNGE BANDS [ABSORPTION PAR L'OXYGENE MOLECULAIRE DANS LES BANDES DE SCHUMMANN-RUNGE]
G. Kockarts 1972 208 p In FRENCH; ENGLISH summary
(A-N-107-1972) Avail: NTIS HC $12.50

Tables covering O2 absorption cross sections are presented for the following temperatures and wavenumber ranges: (1) T = 230 K from 57030.5/cm to 48991/cm, (2) T = 240 K from 57030.5/cm to 48871/cm, and (3) T = 250 K from 57030.5/cm to 48871/cm. The cross section is given every 0.5/cm. Author

N73-16109*# Linguistic Systems, Inc., Cambridge, Mass.
A METHOD OF ANALYSING THE MIXTURE OF HYDROGEN, METHANE, AND ETHANE
E. M. J. Mulders and F. E. C. Scheffer Washington NASA Jan. 1973 14 p refs Transl. into ENGLISH from Rec. Trav. Chim. (Netherlands), v. 49, 1930 p 1057-1065
(Contract NASw-2482)
(NASA-TT-F-14681) Avail: NTIS HC $3.00 CSCL 07D

A method combining accuracy and simplicity is shown for analysis of mixtures of hydrogen, methane, and ethane. The gases are first condensed, then the pressure is decreased by pumping, giving one fraction containing the hydrogen and almost all the methane and the other pure or almost pure ethane. The two fractions are then analyzed separately and the results cross-checked. Author

N73-16110*# Kanner (Leo) Associates, Redwood City, Calif.
STABILITY OF AQUEOUS SOLUTIONS OF HCN IN THE PRESENCE OF AMMONIA OR AMMONIA AND CO2
Seiichi Fujise, Shinsai Nagai, and Takanobu Numata Washington NASA Feb. 1973 12 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 64, no. 11, 1961 p 1889-1891
(Contract NASw-2481)
(NASA-TT-F-14691) Avail: NTIS HC $3.00 CSCL 07D

The stability of aqueous solutions of HCN in the presence of ammonia or ammonia and CO2 was studied as one link in the fundamental research concerning the separation of HCN and ammonia from HCN synthetic gas without using sulfuric acid. The effects of the HCN, NH3, and CO2 concentration, as well as the effects of the temperature were studied. A photoelectric colorimeter was used to measure the degree of coloring caused by polymerization of HCN, and the polymerization velocity was indicated by the inverse number of the time required for coloration up to a definite absorbence. It was established that the polymerization velocity declines remarkably when CO2 is present. It was also learned that when the temperature changes from 40 C to 60 C, the polymerization velocity constant of HCN increases by about 16 times. Author

N73-16111# Joint Publications Research Service, Arlington, Va.
EQUATION OF STATE OF A MIXTURE OF HELIUM AND NITROGEN
V. N. Popov and V. I. Chernyshov 5 Jan. 1973 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. Transp. (Moscow), no. 3, 1971 p 162-165
(JPRS-57923) Avail: NTIS HC $3.00

A computer analysis of experimental data on the compressibility of helium, nitrogen and their mixtures is reported. The equation of state that describes the experimental data in the 273.15-773.15 K temperature range up to a pressure of 400 bar is formulated. Author

N73-16112*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRANSIENT PERMEATION OF ORGANIC VAPORS THROUGH ELASTOMERIC MEMBRANES
James E. Curry 22 Jan. 1973 31 p refs
(NASA-TM-X-64721) Avail: NTIS HC $3.75 CSCL 07D

The permeation of benzene and acetone vapors through sulfur-cured natural rubber was studied by the time-lag method. The zero concentration diffusion coefficient was obtained by the early-time method. The Frisch time lag equation was utilized to estimate both the solubility coefficient and the additional parameter required to define the concentration-dependence of the diffusion coefficient. This form of concentration dependence was manifested by the corresponding permeability coefficient values. At low entering penetrant pressure where the transport coefficients are constant, indirect evidence was obtained that zero diffusion coefficient is the mechanically correct diffusion coefficient. The solubility coefficient values calculated for benzene vapor in natural rubber are in reasonable agreement with published equilibrium sorption data for a similar rubber compound. At higher entering penetrant pressures, average diffusion coefficients obtained at steady state tended to be larger than the corresponding average diffusion coefficients derived from the time-lags. Author

N73-16113*# Kanner (Leo) Associates, Redwood City, Calif.
PARAMETERS FOR OXIDATION RATE OF ORGANIC SUBSTANCES IN LOW-TEMPERATURE OXYGEN PLASMA
K. Hozumi and M. Matsumoto Washington NASA Feb. 1973 25 p refs Transl. into ENGLISH from Bunseki Kagaku (Tokyo), v. 21, 1972 p 206-214
(Contract NASw-2481)
(NASA-TT-F-14671) Avail: NTIS HC $3.25 CSCL 07D

Correlations between oxidation rate parameters of organic substances in a small scale low temperature plasma asher with maximum high frequency power of about 30 W are studied. By using high frequency power input efficiency of about 50%, it was calculated that the electron temperature in plasma at 30 W power was distributed around 15 eV. Electron temperature is expressed as a function of (electric field strength)/(pressure), but related to the oxidation rate of organic substances in an almost linear relationship within pressure range 1 to 2 mm Hg. If inner plasma tube pressure is 1 mm Hg and the oxygen supply is increased, the oxidation rate will rise until the flow rate reaches 20 ml/min, but will become constant above this value. Plasma particles generated inside the electric field were quenched quite rapidly. Sample loss of argon used as the plasma gas indicates that fragmentation caused by electron impact exists in a powerful electric field. Author

N73-16114# Interuniversitair Reactor Instituut, Delft (Netherlands).
AUTOMATED CHEMICAL SEPARATIONS IN ROUTINE ACTIVATION ANALYSIS
P. S. Tjioe, J. J. M. DeGoeij, and J. P. W. Houtman 1972 23 p refs Presented at the 4th Intern. Conf. on Modern Trends in Activation Analysis, Saclay, France, 2-6 Oct. 1972
(IRI-133-72-10) Avail: NTIS HC $3.25

Experience gained through the use of an automated instrument for chemically separating low-concentration trace elements in neutron activation analysis is described. The separation scheme is based on a combination of distillation and ion exchange, and has been used successfully for arsenic, antimony, cadmium, copper, mercury, selenium, and zinc. Special attention was paid to prevention of interference from bromine and sodium. Additional information concerning chromium, cobalt, nickel, and tungsten can easily be obtained. The method has been applied to standard kale powder, and NBS standard orchard leaf powder SRM 1571. Author (ESRO)

N73-16115# Freiburg Univ. (West Germany). Inst. fuer Radiologie.
RADIATION DAMAGE IN ORGANIC, BIOLOGICALLY IMPORTANT SUBSTANCES AND PLASTICS. USE OF PARAMAGNETIC AND NUCLEAR RESONANCE FOR PROOF AND IDENTIFICATION OF FORMED RADICALS [STRAHLENSCHAEDEN IN ORGANISCHEN, SPEZIELL BIOLOGISCHEN PRAEPARATEN UND KUNSTSTOFFEN. ERFORSCHUNG MITTELS PARAMAGNETISCHER RESONANZ UND KERNRESONANZ DURCH NACHWEIS UND IDENTIFIZIERUNG DER GEBILDETEN RADIKALE]
H. Langendorff and H. Moenig Bonn Bundeswehramt 1972 73 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-72-6) Avail: NTIS HC $5.75; Bundeswehramt 25 DM

A number of sulfur-containing substances were investigated for ionizing radiation damage, using electron spin resonance technique. These compounds were examined with regard to the formation of free radicals, in order to obtain more details on the mechanism of radical transfer reactions. The substances investigated were aliphatic compounds, pyridoxine and mercapto derivates, as well as proteins. Molecular structure and time dependent behavior of the free radicals were given special attention. Irradiation with ultraviolet light was also included.
ESRO

N73-16116# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
VEHICLE DETECTION CLASSIFICATION USING CHEMICAL SENSORS
R. P. Murrmann, T. F. Jenkins, L. G. Appel, C. S. Harden, and J. C. Chalcraft Aug. 1972 67 p
(AD-751740; CRREL-SR-181) Avail: NTIS CSCL 15/7

The concept of using chemical sensors for remote surveillance of vehicle activity was evaluated through field and laboratory studies, and consideration of the state of the art of current chemical sensor concepts. Reliable detection of vehicles was found to be feasible at downwind ranges up to several hundred meters depending on the type of chemical sensor employed. By use of a two-sensor array, detection independent of wind direction was highly successful at reduced detection range. False-alarm rates in remote areas were virtually zero due to low levels of exhaust chemicals in ambient air. Potential was shown for classification of diesel and gasoline vehicles by using a classifier unit consisting of two detectors. Author (GRA)

N73-16117# California Univ., San Diego. Dept. of Chemistry.
ASSIGNMENT OF CONTINUOUS SPECTRA BY PHOTOFRAGMENT SPECTROSCOPY: C STATE OF I2
Robert D. Clear and Kent R. Wilson 27 Oct. 1972 20 p refs
(Contract N00014-69-A-0200-6020)
(AD-751611) Avail: NTIS CSCL 07/4

Photofragment spectroscopy has been used to probe the C state of iodine by determining its symmetry and dissociation products. By crossing a molecular beam with a powerful pulsed laser beam in high vacuum and monitoring the arrival times of the recoiling photofragments with a mass spectrometer detector, the translational energy distribution of the photodissociation products was measured. From energy balance the fragment internal energy was then calculated. The peak indicates that the C state dissociates to one excited and one ground state atom. The symmetry of the transition was determined by rotating the plane of polarization of the laser light and measuring a fragment angular distribution. The transition was found to be 1 from 0.
Author (GRA)

N73-16118# Drexel Univ., Philadelphia, Pa. Combustion Kinetics Lab.
COMBUSTION KINETICS OF REENTRY VEHICLE ABLATION MATERIALS
Richard A. Matula Jul. 1972 105 p refs
(Grant AF-AFOSR-2125-71; AF Proj. 9750)
(AD-751270; DUCK-721; AFOSR-72-2052TR) Avail: NTIS CSCL 07/4

The high temperature reactions of COF2 with both CO and H2 in excess argon were studied behind reflected shock waves. The reaction of COF2 and CO, in the temperature and total concentration ranges 2400-3000K and 1.68 - .00002 m/cc, respectively, was found to be insignificant with respect to the unimolecular dissociation of COF2. The reaction of COF2 and H2 was studied in the temperature and total pressure ranges 1900-2700K and 2-12 atmospheres, respectively, varying the COF2 and H2 concentrations from 1/2% -1% to 1/4% -4%, respectively. An empirical relationship for the apparent rate constant of COF2 was found to be virtually independent of the H2 concentration in the range of study. The results of a combined

experimental and analytical study, conducted to determine a plausible COF2 - H2 reaction mechanism, are presented.
Author (GRA)

N73-16119# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CORROSIVE NATURE OF CERTAIN MEDIA IN THE PRODUCTION OF PETROLEUM ADDITIVES
G. A. Allakhverdiev, A. M. Kyazimov, V. G. Yusifov, S. M. Efendizade, and A. F. Agalarova 11 Sep. 1972 12 p refs Transl. into ENGLISH from Azerb. Neft. Khoz. (USSR), no. 1, 1971 p 36-38
(AF Proj. 7343)
(AD-751249; FTD-HT-23-897-72) Avail: NTIS CSCL 11/6

The paper presents the results of experiments on the anti-corrosion resistance of certain structural materials during the condensation of alkylphenol with formalin and ammonia with the subsequent settling and drying of the condensation product.
Author (GRA)

N73-16120# Stanford Univ., Calif. Center for Materials Research.
NEW SUPERCONDUCTORS Semiannual Technical Report, 1 Feb. - 31 Jul. 1972
James P. Collman and William A. Little Sep. 1972 128 p refs
(Contract N00014-67-A-0112-0056; ARPA Order 1681)
(AD-751038; SU-CMR-72-12; SATR-4) Avail: NTIS CSCL 07/2

The report reviews the continuation of the synthetic work in connection with the formation of a model compound for Little's theory of a high temperature superconductor. This includes the preparation of the cyanine dye (diazapolymethinium dye) substituted glyoxime ligand. The design and synthesis of a series of novel iridium and platinum complexes with diazapolymethin dye ligands are also presented. Described is theoretical work on filamentary organo-metallic materials - the conduction mechanism, band theory, and screening process towards the synthesis of metallic chain compounds and related organo-metallic complexes, and experimental studies of their solid state properties. GRA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-16121* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTICHANNEL TELEMETRY SYSTEM Patent
Stanley Butman and Uzi Timor, inventors (to NASA) Issued 9 Jan. 1973 9 p Filed 17 Mar. 1971 Supersedes N71-34159
Sponsored by NASA
(NASA-Case-NPO-11572; US-Patent-3,710,257;
US-Patent-Appl-SN-125234; US-Patent-Class-325-60;
US-Patent-Class-179-15AN; US-Patent-Class-179-15BC;
US-Patent-Class-343-200) Avail: US Patent Office CSCL 09E

A two-channel telemetry system is described in which one channel is used for high-rate data and the other channel for low-rate data communication. In the transmitter a signal, which subsequently phase modulates a carrier, is produced which is a function of at least the high-rate data, the low-rate data and the frequency of the subcarrier of the low-rate channel. In the receiver which includes a phase-locked loop, the high-rate data is detected off the receiver inphase channel output and the low-rate off the quadrature channel output.
Official Gazette of the U.S. Patent Office

N73-16122 Japan Broadcasting Corp., Tokyo. Recording Techniques and Memory Devices Research Group.
ELECTROLESS PLATING TAPE FOR VIDEO TAPE RECORDING (NO. 2): PLATING CONDITION TO IMPROVE TAPE AND HEAD CONTACT
Katsuya Yokoyama and Koichi Ito Aug. 1972 9 p ref
(NHK-Labs-Note-155) Copyright. Avail: Issuing Activity

The effects of plating bath conditions relating to the thickness and magnetic characteristics of video tape recording film are discussed. The level fluctuating rate of the reproducing signal with respect to the thickness of the tape is analyzed. Procedures used during the production of the video tape to control the magnetic characteristics of the plated film are described. Data resulting from experimental evaluations are presented as graphs and tables. P.N.F.

N73-16123 Japan Broadcasting Corp., Tokyo.
CARRIER-TO-INTERFERENCE RATIO REQUIRED FOR FREQUENCY SHARING BETWEEN FM AND AM-VSB TELEVISION SIGNALS
Shigetoshi Kaneda and Takashi Fujio May 1972 13 p refs
(NHK-Labs-Note-153) Copyright. Avail: Issuing Activity

The electromagnetic interference between a frequency modulated television signal for satellite broadcasting and a television signal used for terrestrial broadcasting was investigated. Factors affecting the interference assessment are tabulated. The technical characteristics of the test signals and the test equipment are presented. Graphs of the measured areas of interference are provided. P.N.F.

N73-16124 Japan Broadcasting Corp., Tokyo.
FABRICATION OF NARROW-TRACK VIDEO HEAD WITH SENDUST-SPUTTERED-FILM
Hiromichi Shibaya and Isuke Fukuda Jul. 1972 8 p ref
(NHK-Labs-Note-154) Copyright. Avail: Issuing Activity

The fabrication process of a narrow-track video recording head is described. A schematic diagram of the tetrode sputtering equipment is provided. The parameters of the normal sputtering condition are tabulated. The properties of the magnetic film used with the narrow-track video head are examined. The characteristics of the narrow-track video recording head are analyzed. P.N.F.

N73-16125*# Kentucky Univ., Louisville. Dept. of Electrical Engineering.
DEVELOPMENT OF COMMUNICATIONS ANALYSIS TECHNIQUES Final Report
R. D. Shelton 30 Sep. 1972 9 p refs
(Contract NGR-18-002-026)
(NASA-CR-130272; TR-EE-72-102) Avail: NTIS HC $3.00 CSCL 17B

Major results from the frequency analysis of system program (FASP) are reported. The FASP procedure was designed to analyze or design linear dynamic systems, but can be used to solve any problem that can be described by a system of linear time invariant differential equations. The program also shows plots of performance changes as design parameters are adjusted. Experimental results on narrowband FM distortion are also reported. E.H.W.

N73-16126*# Stanford Univ., Calif. Radioscience Lab.
ELF PROPAGATION IN THE PLASMASPHERE BASED ON SATELLITE OBSERVATIONS OF DISCRETE AND CONTINUOUS FORMS
J. L. R. Muzzio Dec. 1971 124 p refs
(Contract NAS5-3093; Grants NGR-05-020-288; NGL-05-020-008)
(NASA-CR-130351; TR-3439-2; SU-SEL-71-055) Avail: NTIS HC $8.25 CSCL 20N

The propagation of electromagnetic waves in a nonhomogeneous anisotropic medium is examined from the point of view of geometrical optics. In particular, the propagation of ELF waves in the magnetosphere is described in terms of the electron and ion densities and the intensity and inclination of the earth's magnetic field. The analysis of the variations of wave normal angle along the ray path is extended to include the effects of ions. A comparison of the relative importance of each of the above parameters in controlling the orientation of the wave normals is made in the region of the magnetosphere where most of the ion whistlers have been detected. Author

N73-16127*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER CONTROLLED ANTENNA SYSTEM
Nicholas A. Raumann Dec. 1972 54 p refs
(NASA-TM-X-66154; X-811-72-470) Avail: NTIS HC $4.75 CSCL 09E

The application of small computers using digital techniques for operating the servo and control system of large antennas is discussed. The advantages of the system are described. The techniques were evaluated with a forty foot antenna and the Sigma V computer. Programs have been completed which drive the antenna directly without the need for a servo amplifier, antenna position programmer or a scan generator. Author

N73-16128*# Magnavox Co., Silver Spring, Md. Advanced Systems Analysis Office.
DEFINITION OF MULTIPATH/RFI EXPERIMENTS FOR ORBITAL TESTING WITH A SMALL APPLICATIONS TECHNOLOGY SATELLITE Final Report
J. N. Birch and R. H. French 1 Dec. 1972 516 p refs
(Contract NAS9-12705)
(NASA-CR-128717; ASAO-PR20041-8; DRD-MA-129T) Avail: NTIS HC $28.00 CSCL 17B

An investigation was made to define experiments for collection of RFI and multipath data for application to a synchronous relay satellite/low orbiting satellite configuration. A survey of analytical models of the multipath signal was conducted. Data has been gathered concerning the existing RFI and other noise sources in various bands at VHF and UHF. Additionally, designs are presented for equipment to combat the effects of RFI and multipath: an adaptive delta mod voice system, a forward error control coder/decoder, a PN transmission system, and a wideband FM system. The performance of these systems was then evaluated. Techniques are discussed for measuring multipath and RFI. Finally, recommended data collection experiments are presented. An extensive tabulation is included of theoretical predictions of the amount of signal reflected from a rough, spherical earth. Author

N73-16129*# Scientific Translation Service, Santa Barbara, Calif.
MEASUREMENT OF CHARACTERISTICS OF THE APPARATUS FOR SEPARATING PULSE-CODE MODULATION (PCM) SIGNAL IN THE UNIQUE SINGLE TELEMETRY SYSTEM (STMS)
V. V. Lavrusevich Washington NASA 1972 27 p refs Transl. into ENGLISH of "K voprosu izmereniya kharakteristik apparatury vydeleniya signala KIM v yETMS", Acad. of Sci., Inst. for Space Res., Moscow, Report D-148, 1972 30 p
(Contract NASw-2483)
(NASA-TT-F-14657; D-148) Avail: NTIS HC $3.50 CSCL 17B

The principle of constructing a device for forming a test signal of the pseudo-random frame type, and a method for measuring the characteristics of units for extracting telemetry data are discussed. Author

N73-16130*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANTENNA DIMENSIONS OF SYNTHETIC APERTURE RADAR SYSTEMS ON SATELLITES
Kurt R. Richter Jan. 1973 16 p ref Submitted for publication
(NASA-TM-X-66162; X-730-73-9) Avail: NTIS HC $3.00 CSCL 17I

Design of a synthetic aperture radar (SAR) for a satellite must take into account the limitation in weight and dimensions of the antenna. The lower limits of the antenna area are derived from the conditions of unambiguity of the SAR system. This result is applied to estimate the antenna requirements for SARs on satellites in circular orbits of various altitudes around Earth and Venus. Author

N73-16131*# Illinois Univ., Urbana. Observatory.
DOPPLER FREQUENCY IN INTERPLANETARY RADAR AND GENERAL RELATIVITY Final Report
G. C. McVittie Nov. 1972 20 p refs
(Grant NGR-14-005-088)
(NASA-CR-130147) Avail: NTIS HC $3.00 CSCL 17I

The change of frequency of an interplanetary radar signal sent from the earth to another planet or to a space probe is worked out according to general relativity. The Schwarzschild spacetime is employed and its null geodesics control the motion of the signals. Exact Doppler frequency formulas are derived for one-way and two-way radar in terms of an arbitrary Schwarzschild radial coordinate. A reduction to the special relativity case is used to interpret the formulas in terms of the relative radial velocity of emitter and target. The general relativity corrections are worked out approximately for each of three possible Schwarzschild radial coordinates, and a numerical example is given. The amount of the correction is different according as one or the other of the Schwarzschild coordinates is identified with the radius vector deduced from classical celestial mechanics. The identification problem is discussed. Author

N73-16132*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TECHNIQUE FOR RECOVERY OF VOICE DATA FROM HEAT DAMAGED MAGNETIC TAPE Patent Application
Joe F. Melugin and David E. OBrien, III, inventors (to NASA) Filed 16 Jan. 1973 12 p
(NASA-Case-MSC-14219-1; US-Patent-Appl-SN-324029) Avail: NTIS HC $3.00 CSCL 14C

A method is presented for conditioning, and thus enabling retrieval of intelligence from magnetic tape after damage from heat has caused the tape to wrinkle, curl severely, and be reduced to less than one-half its original size. The damaged tape is superposed on a first piece of splicing tape with the oxide side of the magnetic tape in contact with the adhesive side of the splicing tape and then carefully smoothed by a special tool. A second piece of splicing tape is placed on the backing side of the magnetic tape then the resulting tape stack is trimmed to the original width of the magnetic tape. After the first piece of splicing tape is carefully removed from the oxide side of the damaged magnetic tape, the resulting magnetic tape is then ready to be placed into a recorder for playback. NASA

N73-16133# Lockheed Missiles and Space Co., Palo Alto, Calif.
VIDEOCOHERENT SYSTEMS
D. S. Kontorov and Iu. S. Golubov-Novozhilov [1972] 18 p Transl. into ENGLISH from the book "Vvedenie v Radiolokatsionnuiu Sistemotekhniku" Moscow, Sovetskoe Radio, 1971 p 196-220
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The characteristics and operation of videocoherent systems with respect to power resources and frequency distribution are discussed. A diagram of the system with several transmitting and receiving sites, in which each reflected signal is received by all the receiving sites independently of which probing signal is illuminating the target is presented. Methods for obtaining improved performance of the system are described. Mathematical models are provided to amplify the text. P.N.F.

N73-16134# Lockheed Missiles and Space Co., Palo Alto, Calif.
INCOHERENT SYSTEMS
D. S. Kontorov and Iu. S. Golubov-Novozhilov [1972] 8 p Transl. into ENGLISH from the book "Vvedenie v Radiolokatsionnuiu Sistemotekhniku" Moscow, Sovetskoe Radio, 1971 p 185-195
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The use of matched incoherent radar systems to improve the accuracy of range measurement is discussed. The improved accuracy is achieved by using several matched radars operating at different frequencies to cancel atmospheric errors. The system may also use two radars, one of which measures azimuth while the other measures elevation. Low diversity system is also used to increase the probability of target detection. Diagrams of the radar installation and mathematical models of the operating parameters are included. P.N.F.

N73-16135*# Ohio State Univ., Columbus. ElectroScience Lab.
HIGH PERFORMANCE S-BAND HORN ANTENNAS FOR RADIOMETER USE
R. Caldecott, C. A. Mentzer, L. Peters, and J. Toth Washington NASA Jan. 1973 110 p refs
(Contract NAS1-10040)
(NASA-CR-2133) Avail: NTIS HC $3.00 CSCL 09A

Horn antennas of four types: pyramidal corrugated, conical corrugated, pyramidal dual mode and conical dual mode, have been constructed and evaluated for use as S-band radiometer antennas. Each of the structures is described and radiation patterns and impedance and resistive loss measurements including a layer of foreign material on a thin radome, are presented. A precision method for determining reflection losses is described using a

multiprobe reflectometer technique. The same technique is also applied to the measurement of resistive losses by closing the ends of the antennas with short circuit plates and determining the losses from an accurate measurement of the reflection coefficient. The radiation patterns were recorded with the aid of a real-time digital computer. The stored patterns were then processed to yield gain and beam efficiency. It was concluded that it is possible to design a highly efficient antenna for radiometer use and to measure its parameters precisely. However, it was found that it is necessary to modify the conventional definition of beamwidth somewhat if this term is to be meaningful for radiometer applications. Author

N73-16136# Princeton Univ., N.J. Plasma Physics Lab.
MEASUREMENT OF EFFECTIVE COLLISION FREQUENCY IN RF HEATING THROUGH PARAMETRIC INSTABILITIES
T. K. Chu and H. W. Hendel [1972] 10 p refs Presented at 1st Topical Conf. on RF Plasma Heating, Lubbock, Tex., 6 Jul. 1972
(Contracts AT(11-1)-7073; F30602-72-C-0053)
(Conf-720705-2) Avail: NTIS

Enhanced absorption of an em wave near omega sub pe was observed, coincident with the onset of parametric decay instability, in a Q-device plasma. The effective collision frequency nu sub eff is approximately equal to nu sub ei (E/E sub cr)2. Author (NSA)

N73-16137# Princeton Univ., N.J. Plasma Physics Lab.
OBSERVATION OF NONLINEAR EFFECTS NEAR THE LOWER HYBRID RESONANCE FREQUENCY
W. M. Hooke and S. Bernabei [1972] 4 p refs Presented at 5th European Conf. on Controlled Fusion and Plasma Phys., Grenoble, France, 21 Aug. 1972
(Contract AT(30-1)-1238)
(Conf-720804-3) Avail: NTIS

Waves near the lower hybrid resonance frequency are electrostatically generated with plates just outside a cylindrical plasma column. These waves penetrate radially and, above a threshold power, are observed to undergo a parametric decay into two lower-frequency waves. Author (NSA)

N73-16138# Princeton Univ., N.J. Plasma Physics Lab.
OBSERVATION OF A PARAMETRIC INSTABILITY NEAR THE LOWER HYBRID FREQUENCY
W. M. Hooke and S. Bernabei [1972] 8 p refs Presented at 1st Topical Conf. on RF Plasma Heating, Lubbock, Tex., 6 Jul. 1972
(Contract AT(11-1)-3073)
(Conf-720705-4) Avail: NTIS

A parametric instability was observed at frequencies close to and somewhat above the lower hybrid resonance frequency. The threshold for this decay occurs when the RF electron drift velocity is of the order of the ion sound speed. Author (NSA)

N73-16139# Los Alamos Scientific Lab., N.Mex.
PARAMETRIC INSTABILITIES OF VLF WAVES
D. W. Forslund, J. M. Kindel, and E. L. Lindman [1972] 6 p refs Presented at Sub-LF Downlink Satellite Commun. Conf., Washington, D.C., 6 Jun. 1972 Sponsored by AEC
(LA-DC-72-746; Conf-720644-1) Avail: NTIS

Instabilities of whistler waves in the radiation belts are discussed. An analysis of the dispersion relations reveals certain parametric instabilities. Some nonlinear results of computer calculations are described. NSA

N73-16140# California Univ., Livermore. Lawrence Livermore Lab.
ELECTROMAGNETIC PROPAGATION, TRANSMISSION, REFLECTION, AND REFRACTION: EQUATIONS AND NUMERICAL RESULTS
R. Jeff Lytle and Darrel L. Lager 20 Jun. 1972 105 p refs
(Contract W-7405-eng-48)
(UCRL-51245) Avail: NTIS

Equations are presented that define the more commonly encountered electromagnetic field parameters. Graphs give the numerical results calculated from these equations. Parameters treated are skin depth, phase constant, intrinsic impedance, refraction angle, and plane-wave reflection and transmission, and coefficients for above- and below-surface incidence. Results are given for media with relative dielectric constants of 9, 25, and 81, and conductivities of 0.000001 to 10 mho/m. Frequencies are from 1 to 10 to the 9th power Hz, and ratios of conduction currents to displacement currents are 0, 0.3, 1, 10, and 1000. Author

N73-16141# California Univ., Livermore. Lawrence Livermore Lab.
BASEBAND DISTORTION EQUILIZATION IN THE TRANSMISSION OF PULSE INFORMATION
M. P. Ekstrom 1 Jun. 1972 27 p refs Presented at Conf. on Precision Electromagnetic Meas., Boulder, Colo., 26-29 Jun. 1972 Submitted for publication Sponsored by AEC
(UCRL-73943; Conf-720624-1) Avail: NTIS

Baseband equalization techniques are applied to the problem of correcting the response characteristics of subnanosecond pulse transmission systems. In particular, a description is given of a system used in the equalization of high quality coaxial transmission lines. The fundamental aspects of the system, the channel characterization, network design, and subsequent realization, are discussed in detail. Some experimental results are also presented which demonstrate the applicability of the system. Author

N73-16142# Admiralty Surface Weapons Establishment, Portsmouth (England).
A PRINTED CIRCUIT ANTENNA IN THE VHF BAND
J. E. G. Wyatt Apr. 1972 18 p
(TR-72-34; BR-32391) Avail: NTIS HC $3.00

A VHF omnidirectional antenna is described, which is developed as a printed circuit panel from a flat plate dipole with low aspect ratio for ships. Author (ESRO)

N73-16143# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A DIGITAL-OPTICAL HYBRID CORRELATOR
R. A. Meyer, D. G. Grant, and J. L. Queen Sep. 1972 131 p refs
(Contract N00017-72-C-4401)
(AD-751695; APL-TG-1193A) Avail: NTIS CSCL 17/9

A Digital-Optical Hybrid Correlator with the capability of processing pulse Doppler and wideband radar signals has been developed based on the correlation properties of an optical phased array. This hybrid system retains the flexibility of digital technology for signal storage and registration, and the speed of coherent optical technology for performing the signal correlation. Two phased-array modulators have been developed. The Membrane Light Modulator is a mirror whose surface can be deflected in localized areas by electrostatic forces. The multichannel crystal modulator employs the electro-optic properties of lithium tantalate to achieve phase modulation. Both modulators have been used to perform optical phased-array beam steering. Pulse Doppler and wideband radar signals have been processed by the hybrid correlator. The system's capability to perform two-dimensional correlation of frequency diversity radar waveforms has been demonstrated. Author (GRA)

N73-16144# Naval Underwater Systems Center, Newport, R.I.
SIGNAL-TO-NOISE RATIOS REQUIRED FOR SHORT TERM NARROWBAND DETECTION OF GAUSSIAN PROCESSES
Albert H. Nuttall and Anthony F. Margaraci 20 Oct. 1972 33 p refs
(AD-751573; NUSC-TR-4417) Avail: NTIS CSCL 09/4

The required signal-to-noise ratios for short-term detection of a narrowband Gaussian signal process in Gaussian noise are computed for false alarm probabilities 10 sup (-n), n = 1 (1)8; detection probabilities 0.5, 0.7, 0.9, 0.99; and observation-time analysis-bandwidth products in the range of 0 to 100. No assumptions are made about Gaussian statistics of the decision variable, or about long observation intervals. It is found that the required signal-to-noise ratios are significantly greater in some cases than those predicted from a simple deflection criterion of system performance. Author

N73-16145# Stanford Research Inst., Menlo Park, Calif.
REVIEW OF THE MAGNETOSPHERIC WAVE-PARTICLE INTERACTION WORKSHOP
John F. Vesecky Oct. 1972 61 p refs Workshop held at

Menlo Park, Calif., 11-13 Jul. 1972
(Contract N00017-72-C-0402; ARPA Order 2141; SRI Proj. 1840)
(AD-751568; SRI-1840-SR) Avail: NTIS CSCL 04/1

A workshop on magnetospheric wave-particle interaction sponsored by ARPA and ONR was held at Stanford Research Institute, Menlo Park, California on 11-13 July 1972. The general view of the workshop participants was that significant wave amplification at ULF and VLF frequencies can be artificially stimulated by injecting cold plasma outside the plasmapause in the magnetosphere, and that specific military applications for such wave amplification (communications) and its associated particle precipitation (nuclear weapons effects) are possible. The following subjects were discussed: (1) potential military applications, (2) physics of the wave-amplifying mechanism, (3) experimental observations and current theory of ULF and VLF wave-particle interaction, and (4) design of experiments to investigate wave-particle interaction phenomena. It was also the view of the workshop participants that further research should be carried out to design an optimum experimental investigation of cold-plasma-injection phenomena. A detailed list of the necessary research topics was prepared and is included in the report. Author (GRA)

N73-16146# Naval Ordnance Lab., White Oak, Md.
OPTIMUM ESTIMATION OF A DELAY VECTOR CAUSED BY A RANDOM FIELD PROPAGATING ACROSS AN ARRAY OF NOISY SENSORS (Ph.D. Thesis - Md. Univ., College Park)
William R. Hahn 16 Jun. 1972 74 p refs
(AD-751555; NOLTR-72-120) Avail: NTIS CSCL 09/4

The problem of optimally processing multiple sensor data to determine the set of time delays generated by the propagation across an array of the wave fronts from a distant wide-band Gaussian noise source is investigated. It is assumed that the amplitude gradient across the array of the noise field is negligible, that the array outputs are corrupted by additive wide-band Gaussian independent sensor noises, and that the observation time is long. The Fisher Information Matrix is determined, and then used to show that the maximum likelihood estimate is asymptotically efficient (as theory dictates it should be). It is also shown that filtered correlator systems can provide asymptotically efficient estimates. Finally, the effects of suboptimal filtering of the inputs to a correlator system are investigated for the case when the signal and additive noise spectra are all band limited and have constant slopes of 0, -3, or -6 dB/octave. Author (GRA)

N73-16147# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
RAINFALL EFFECTS ON SATELLITE COMMUNICATIONS IN THE K, X, AND C BANDS
Israel Cantor Jul. 1972 80 p refs
(DA Proj. 1T0-6211-A-126)
(AD-751742; ECOM-5459) Avail: NTIS CSCL 17/2

A survey-type investigation is made into the feasibility of short- and long-term predictions of attenuation and noise temperature fluctuations for satellite communications. The feasibility of using a weather radar, such as the AN/CPS-9, at 9.4 GHz (3.2 cm) for real-time predictions of the above parameters is explored. The suitability of weather radar for such applications is evaluated. Raindrop size data and Mie attenuation theory are used for the derivation of statistical curves that provide attenuation coefficients for various geographic areas and temperatures. Author (GRA)

N73-16148# Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
EFFECTS OF DATA QUANTIZATION AND DISPLAY CONTRAST ON DETECTION IN INTENSITY MODULATED DISPLAYS
Robert A. Rasmussen 1 Oct. 1972 16 p refs
(Contract N00014-69-A-0200-6002)
(AD-751711; SIO-Ref-72-73; MPLOU-53/72) Avail: NTIS CSCL 17/1

Subjective studies of visual perception of targets in homogeneous noise backgrounds reveal that neither the number of quantized luminance levels nor the display contrast, i.e., the ratio of maximum to minimum values of luminance available in the display, have an appreciable effect on target visibility. Increasing the number of quantized levels reduces the coarseness of the background; however, the brightness contrast of the target is reduced simultaneously in such fashion as to maintain the ratio of target contrast to background fluctuation nearly constant. The experimental results also demonstrate a large variance of visibility thresholds among the several observers employed that cannot be attributed to experience or training. As is true of electronic and mechanical signal processing devices, certain human processors are much more effective than others for a particular detection task. Author (GRA)

N73-16149# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
REPORT OF THE DOD GEOCEIVER TEST PROGRAM
Jul. 1972 195 p refs Sponsored by Navy
(AD-751597; DMA-0001) Avail: NTIS CSCL 08/5

A test program was designed to evaluate the capabilities of the AN/PRR-14, a portable Doppler Geodetic Receiver (GEOCEIVER). Geoceiver data acquired jointly by each of the three Services were assembled and processed by each to determine the precise positions of the observing stations. Geoceiver was shown to be an instrument of excellent geodetic capability. Automatic-mode operation was found to be efficient and economical. Data produced by Geoceiver were prepared for final computation by transfer to magnetic tape, editing, satellite identification (unscrambling), and archiving for subsequent recall. Comparisons are made between point positioning, translocation, and short-arc techniques, using coordinates from the National Ocean Survey High Precision Geodimeter Traverse as the standard. Author (GRA)

N73-16150# Florida Univ., Gainesville. Communication Science Lab.
UNDERWATER SPEECH COMMUNICATION Annual Summary Report, 1 Jun. 1971 - 31 May 1972
Harry Hollien, Howard B. Rothman, and Stephen H. Feinstein
1 Jul. 1972 16 p
(Contract N00014-68-A-0173-0008; NR Proj. 196-114)
(AD-751665; CSL/ONR-48) Avail: NTIS CSCL 17/2

Studies completed were: Diver-to-surface communication (near field and over distance); diver-to-diver communication; speech modification in helium at 300 feet; off-line evaluation of the RELA unscrambler; underwater microphone evaluation; diver auditory acuity; minimum audible angle of scuba divers. Studies nearing completion: Speech intelligibility in neon at depths of 300-680 feet; speech feedback (divers underwater hear their own speech immediately after their utterances and attempt modification for better intelligibility). Author (GRA)

N73-16151# California Univ., Los Angeles. Plasma Physics Group.
ELECTROMAGNETIC WAVE FUNCTIONS FOR PARABOLIC PLASMA DENSITY PROFILES
Alfredo Banos, Jr. and Daniel L. Kelly Oct. 1972 38 p refs
(Contract N00014-69-A-0200-4023)
(AD-751669; PPG-125) Avail: NTIS CSCL 20/14

Making use of an extension of Langer's method, the one dimensional Helmholtz equation w' + k sub 0 squared g(z) w(z) = 0 is solved, in which K sub 0 = 2pi/lambda sub 0 is the free space propagation constant and g(z) is any one of the three characteristic profiles. Only the Epstein profiles are considered g(z) = g(0) + (1-g(0)) tanh squared (z/2pi), where g(0) is the intercept at the origin and lambda is the scale length, corresponding to no turning points, a quadratic turning point at z = 0, or a pair of turning points at z = plus or minus b, depending on where g(0) is positive, zero, or negative. The solution is found in terms of confluent hypergeometric functions with parameters c = 1/2 and a = 1/4 - i eta, where eta is a parameter characterizing the curves and carrying the same sign as g(0) above, with eta = 0 when g(0) = 0. An application to parabolic plasma density profiles is obtained through the use of power series and asymptotic expansions that yield useful information on the tuning criterion for parametric excitation of the ionosphere. Author

N73-16152# University of Southern Calif., Los Angeles. Dept. of Industrial and Systems Engineering.
ON A PROBLEM IN SCHEDULING TIME DEPENDENT EVENTS Interim Report
Bennet P. Lientz and Henry L. Pfister Oct. 1972 19 p refs
(Grant AF-AFOSR-2025-71; AF Proj. 9769)
(AD-751290; AFOSR-72-2066TR) Avail: NTIS CSCL 17/9

The paper presents an approach to a problem in the scheduling of events in a time dependent context. The problem framework is a radar network wherein there are critical time thresholds for tracking satellites and for setting up and performing observations on board the satellites. The objective in the scheduling is to maximize the sum of the values associated with the experiments selected and performed. More specifically, the goal is to rapidly obtain good, near optimal solutions which satisfy the operating conditions of the environment. A procedure is outlined for testing sensitivity to weights on the relative value of various experiments. Computational results from implementation are given. Author (GRA)

N73-16153# Florida Univ., Gainesville. Communication Science Lab.
STANDARDIZATION OF SPEECH MATERIALS FOR UNDERWATER RESEARCH. 1: COMPARATIVE INTELLIGIBILITY OF MONOSYLLABIC WORD LISTS
Robert F. Coleman and Harry Hollien 1 Sep. 1972 16 p refs
(Contract N00014-68-A-0173-0008; NR Proj. 196-114)
(AD-751662) Avail: NTIS CSCL 17/2

Two experiments are reported in which the underwater intelligibility scores of four standard word lists were compared. As would be expected, closed-set word lists produced higher scores than did open-ended tests. Alternate forms of two tests were compared and the results indicated that lists which are equated for difficulty in normal environments also are reasonably equated underwater. A preliminary analysis of phoneme type distortion was derived from one closed-set test. The results appeared to demonstrate that, for this type of experiment, the most common phoneme error was in place of production and that fricatives were most affected. Author (GRA)

N73-16154# Stanford Research Inst., Menlo Park, Calif.
POWER HANDLING CAPABILITY OF ECM ANTENNAS Final Report, 1 Jul. 1970 - 30 Jun. 1972
Gerald August, John B. Chown, and William C. Taylor Sep. 1972 41 p refs Prepared for Lincoln Lab., MIT, Lexington, Mass.
(Contract F19628-70-C-0230; AF Proj. 627A; SRI Proj. 8066)
(AD-751309; ESD-TR-72-238) Avail: NTIS CSCL 17/4

The electrical breakdown characteristics of the LPJ-1 and the SLOT L-1 antennas furnished by Lincoln Laboratory were measured. Modifications to increase the power-handling capability of the SLOT L-1 antenna were suggested. The effect of laser irradiation on antenna breakdown was investigated using ruby and CO2 lasers. The antenna studied was a dielectric plugged X-band waveguide. Blackout times and altitudes were estimated for the TBV vehicle C-band beacon and S-band telemetry antennas. Author (GRA)

N73-16155# Westinghouse Electric Corp., Baltimore, Md. Systems Development Div.
ONE KILOWATT SOLID STATE L-BAND TRANSMITTER DEVELOPMENT Final Technical Report
David G. Laighton and Kurt P. Schwan Sep. 1972 54 p
(Contract F30602-71-C-0215)
(AD-751279; RADC-TR-72-235) Avail: NTIS CSCL 09/5

The report is a detailed description of efforts expended in the demonstration of feasibility of a one kilowatt L-band solid state power amplifier. The report describes the logic used in arriving at a design approach, selection of an amplifier configuration, device selection and the design and fabrication of the final amplifier model. The tests and evaluation of the component parts and the complete module are also extensively reported. The report describes in detail the design and development of a 1:12 power splitter, fabrication of twelve 100 watt amplifiers and a 12:1 power combiner. Author (GRA)

N73-16156# Litton Systems, Inc., Melville, N.Y. LITCOM Div.
NON-BLOCKING UHF COMMUNICATIONS SYSTEM (BASECOM) Final Technical Report, Mar. 1971 - Mar. 1972
Tore N. Anderson and William Sheets Griffiss AFB, N. Y. RADC Oct. 1972 64 p
(Contract F30602-71-C-0169)
(AD-751263; Rept-50071-12; RADC-TR-72-252) Avail: NTIS CSCL 17/2

The report describes the design, construction, and test of a non-blocking UHF communications terminal. The terminal consists of four transmitters and four receivers contained in a single 19-inch rack enclosure. The unique design of the terminal allows operation of the transmitters and receivers on adjacent 50-kilohertz channels anywhere in the 406-megahertz (MHz) to 420 MHz frequency band without mutual interference. This is accomplished through the use of spectrally pure transmitters and extremely low intermodulation receivers in a four-channel concept using a common receiver front end. A manually adjustable interference cancellation network is used to optimize system performance. The system uses a single high gain, omni-directional antenna for both transmit and receive. Author (GRA)

N73-16157# Florida Univ., Gainesville. Communication Sciences Lab.
FURTHER EVALUATION OF HeO2 UNSCRAMBLERS UNDER CONTROLLED CONDITIONS
Harry Hollien, Howard B. Rothman, and Stephen H. Feinstein 1 Jul. 1972 20 p refs
(Contract N00014-68-A-0173-0008; NR Proj. 196-114)
(AD-751034; CSL/ONR-47) Avail: NTIS CSCL 17/2

Data are presented on relative speech intelligibility as processed via unscramblers under two conditions: on-line and off-line. The report provides a discussion of the strengths and weaknesses of current approaches to HeO2 speech processing and makes recommendations for the improvement of these devices. GRA

N73-16158# Stanford Research Inst., Menlo Park, Calif.
DNA PROJECT 609 ISLAND RADAR PHASED ARRAY Final Report, 30 Jun. 1970 - 31 Jul. 1972
Ronald I. Presnell, Boyd C. Fair, Herbert W. Kunnes, Arvid G. Larson, and Neil S. Stafford Jul. 1972 64 p refs
(Contract DASA01-69-C-0064; SRI Proj. 7882)
(AD-751054; DNA-2943F; Rept-2) Avail: NTIS CSCL 09/5

The report describes the design and development of an electronic-scan phased-array antenna system and a digital clutter-mapping system for use with the DNA Project 609 400-MHz radar system. The phased array is capable of plus or minus 20 degrees of electronic beam steering and full hemispheric mechanical steerability. It is composed of 780 short-backfire radiators with a total gain of 36 db. It is vertically polarized and has phase-monopulse-tracking ability. The electronic beam forming and steering is controlled by a digital system using a PDP-11/20 general-purpose computer system. The same computer is used to control the digital clutter-mapping system which is composed of an A/D converter, multiplexer, digital tape recorder, high-speed disk storage, and an intensity-modulated graphic recorder. The digital mapping system is capable of sampling the phased-array radar video data and presenting a variety of three-dimensional plots of radar clutter data. Author (GRA)

N73-16159# General Motors Corp., Goleta, Calif. Delco Electronics Div.
REMOTE AUTOMATIC MULTIPURPOSE STATION
Walter P. Brown and B. M. Buck Oct. 1972 5 p refs
(Contract N00014-71-C-0357; ARPA Order 1783; NR Proj. 307-340)
(AD-751039; TR-5) Avail: NTIS CSCL 09/6

The report describes monitoring of the remote automatic multipurpose stations which were established to provide remote sensing of oceanographic and meteorological data in the Arctic Regions. GRA

N73-16374* Radio Corp. of America, New York.
TELEVISION CAMERAS
Otto H. Schade, Sr. *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 245-261 refs (For availability see N73-16348 07-13)
CSCL 17B

N73-16377* Kansas Univ./Center for Research, Inc., Lawrence.
RADAR AND MICROWAVE RADIOMETRY
Richard K. Moore *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 283-301 (For availability see N73-16348 07-13)
CSCL 17I

N73-16399* Geological Survey, Washington, D.C.
SATELLITE RELAY TELEMETRY OF SEISMIC DATA IN EARTHQUAKE PREDICTION AND CONTROL
Wayne H. Jackson and Jerry P. Eaton *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 322-343 (For availability see N73-16382 07-13)
CSCL 09F

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-16160*# Aerojet Electrosystems Co., Azusa, Calif.
EARTH RESOURCES DATA ANALYSIS SYSTEM Final Report
Oct. 1972 47 p
(Contract NAS9-12106)
(NASA-CR-128693; Rept-1746FR-1) Avail: NTIS HC $4.50 CSCL 09B

The Earth Resources Laboratory Data Analysis System provides a valuable research tool in the evaluation of multispectral, radiometric, photographic, and passive microwave imagery data. The system has been in operational use for several months and has performed quite well. Emphasis on versatility of both the hardware and software design facilitates system expansion to many specialized data analysis tasks. The many independent software handlers provide building blocks for major processing programs. Author

N73-16161*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
MULTISPECTRAL DATA COMPRESSION THROUGH TRANSFORM CODING AND BLOCK QUANTIZATION
Patrick J. Ready and Paul A. Wintz [1972] 159 p refs
(Grant NGL-15-005-112)
(NASA-CR-130365; LARS-Inform-Note-050572; TR-EE-72-2) Avail: NTIS HC $10.00 CSCL 05B

Transform coding and block quantization techniques are applied to multispectral aircraft scanner data, and digitized satellite imagery. The multispectral source is defined and an appropriate mathematical model proposed. The Karhunen-Loeve, Fourier, and Hadamard encoders are considered and are compared to the rate distortion function for the equivalent Gaussian source and to the performance of the single sample PCM encoder. Author

N73-16162*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER SOFTWARE DOCUMENTATION
P. A. Comella Jan. 1973 34 p refs
(NASA-TM-X-66161; X-641-73-4) Avail: NTIS HC $3.75 CSCL 09B

A tutorial in the documentation of computer software is presented. It presents a methodology for achieving an adequate level of documentation as a natural outgrowth of the total programming effort commencing with the initial problem statement and definition and terminating with the final verification of code. It discusses the content of adequate documentation, the necessity for such documentation and the problems impeding achievement of adequate documentation. Author

N73-16163*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BINARY CONCATENATED CODING SYSTEM Patent Application
Leo G. Monford, Jr., inventor (to NASA) Filed 14 Dec. 1972 23 p
(NASA-Case-MSC-14082-1; US-Patent-Appl-SN-315070) Avail: NTIS HC $3.25 CSCL 09B

A binary notation system of measuring, counting, and recording numerical information with a minimized number of digits or bits may be better utilized than the binary pulse code modulation system or the delta modulation system. In the binary concatenated coding system, a 3-bit data word is used to count all whole numbers from zero through 99, whereas the binary system requires 7 bits. In any of the 10 decades this is accomplished by starting with a one, progressing stepwise from one to seven and then to zero in a binary fashion, thus providing eight positions corresponding to the first eight numbers of the Arabic system. The ninth and tenth positions are occupied by two of these same eight numbers so selected and arranged that they uniquely describe the decade completed by them relative to the other nine decades of the total count capability of one hundred. NASA

N73-16164*# Purdue Univ., Lafayette, Ind. Lab. for Applications for Remote Sensing.
DATA HANDLING AND ANALYSIS FOR THE 1971 CORN BLIGHT WATCH EXPERIMENT
Paul E. Anuta and Terry L. Phillips [1973] 16 p refs
(Grant NGL-15-005-112)
(NASA-CR-130368; LARS-Print-080172) Avail: NTIS HC $3.00 CSCL 05B

The overall corn blight watch experiment data flow is described and the organization of the LARS/Purdue data center is discussed. Data analysis techniques are discussed in general and the use of statistical multispectral pattern recognition methods for automatic computer analysis of aircraft scanner data is described. Some of the results obtained are discussed and the implications of the experiment on future data communication requirements for earth resource survey systems is discussed. Author

N73-16165*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SD-4080OCPLT4 PROGRAM, USER'S GUIDE
Joel Glazer Jan. 1973 97 p refs Prepared by Computer Sci. Corp., El Segundo, Calif.
(Contract NAS5-11790)
(NASA-TM-X-66164; X-552-73-12) Avail: NTIS HC $7.00 CSCL 09B

A brief description of the Orbit Comparison Plot (OCPLT4) program is presented, along with user information and a source program listing. In addition to correcting several errors that existed in the original program, this program incorporates the following new features: (1) For any satellite whose observations are processed by the Definitive Orbit Determination System (DODS), the orbital uncertainty estimates (OUE) can be obtained via appropriate card input with no major modification to the program. (2) All satellite-related information (e.g., plotter scales, cutoff limits, plotting frequencies) is user controlled via card input. (3) Not all components of OUE must be obtained. The user has the option of obtaining only the radial component if there is no need for the other two components. (4) The altitude and time graph formats are controlled by the user and are not stored for specific satellites. Author

N73-16166# Analysis and Computer Systems, Inc., Burlington, Mass.
DATA PROCESSING SYSTEMS FOR EXPERIMENTS FLOWN ON THE INJUN 5, OV3-6 AND OV1-15 SATELLITES Final Report, 1 Jun. 1969 - 31 May 1972
Leonard L. Dalton, James R. Delaney, Richard H. Desrochers, Arthur J. Markey, and David T. Williams Jun. 1972 155 p refs
(Contract F19628-70-C-0060)
(AD-751508; AFCRL-72-0384) Avail: NTIS CSCL 09/2

The processing of satellite telemetry data encompasses many programming techniques in the effort to provide the researchers with the experimental results. A Satellite Data Reduction Processor System (SADAR) was developed to provide a general system for retrieval of experimental measurements. The report discusses, in depth, the application of SADAR to the processing of the OV3-6 and OV1-15 experimental data. The system is quite flexible and was designed for adaptation to future satellites. The report also includes a description of the data processing

effort for the spherical electrostatic analyzer experiment flown on the INJUN 5 satellites. Author (GRA)

N73-16167# Naval Postgraduate School, Monterey, Calif.
MINICOMPUTER UTILIZATION FOR DATA ACQUISITION AND PROCESSING M.S. Thesis
Philip Neal Hatfield Sep. 1972 57 p refs
(AD-751636) Avail: NTIS CSCL 09/2

An investigation is conducted of minicomputer use for data acquisition and/or processing functions. The study is directed primarily toward the suitability of the on-board Data 620 minicomputer system for performance of these functions. System configuration and a listing of available software are included in addition to applicable system operating procedures. Finally, illustrative I/O software routines required to service a proposed data processing task are presented. Author (GRA)

N73-16168# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE USE OF ELECTRO-HYDRAULIC ELEMENTS IN COMPUTER TECHNOLOGY
A. A. Denisov and V. S. Nagornyi 22 Sep. 1972 14 p refs Transl. into ENGLISH from Tr. Polytekhn. Inst. Leningrad (USSR), no. 303, 1969 p 54-57
(FTD Proj. T71-05-09; FTD Proj. T71-05-13)
(AD-751246; FTD-HT-23-1270-72) Avail: NTIS CSCL 09/2

It is proposed that for the conversion of electrical signals into hydraulic signals one could use a choke type electrostatic hydraulic converter in which all moving elements have been eliminated. Author (GRA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-16169 Liege Univ. (Belgium). Dept. of Electrical Engineering.
SEMINAR ON STABILITY OF LARGE-SCALE POWER SYSTEMS
M. Ribbens-Pavella, ed. North Hollywood, Calif. Western Periodicals Co. Jun. 1972 137 p refs Conf. held at Liege, 19-22 Jun. 1972
Copyright. Avail: Western Periodicals Co., 13000 Raymer St., North Hollywood, Calif. 91605

Procedures for analyzing stability in large scale electrical power systems are given. Detailed summaries cover multimachine systems, multiarea systems, discrete composite systems, and systems with parasitic elements. Summaries are also given for nonlinear feedback system and transient power systems. For individual titles, see N73-16170 through N73-16182.

N73-16170 Centro Ricerca di Automatica, Milan (Italy).
STABILITY REQUIREMENTS IN ELECTRIC POWER SYSTEMS
Giorgio Quazza *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 1-10 (For availability see N73-16169 07-09)
Copyright.

Stability problems arising in electric power systems, their requirements, and methods used to solve them are examined. Research results show present methods, algorithms, and programs do not appear to satisfy all the needs of power system control, scheduling, and planning. E.H.W.

N73-16171 Liege Univ. (Belgium). Dept. of Electrical Engineering.
SURVEY OF STUDIES ON TRANSIENT POWER SYSTEM STABILITY BY LIAPUNOV'S DIRECT METHOD
M. Ribbens-Pavella *In its* Seminar on Stability of Large-Scale Power Systems Jun. 1973 p 11-23 refs (For availability see N73-16169 07-09)
Copyright.

Liapunov's direct method, as applied to the transient stability of multimachine power systems, is studied. Data cover (1) system capacity to recover, after disturbances, a synchronous steady state operations, (2) determination of a stability index of a given system, and (3) determination of an expected gain on computational time which will permit on-line computations in transient stability studies. E.H.W.

N73-16172 Ghent Univ. (Belgium). School of Engineering.
OUTPUT STABILITY, NONLINEAR FEEDBACK SYSTEMS, AND TRANSIENT POWER SYSTEM STABILITY ANALYSIS
Jacques L. Willems *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 24-33 refs (For availability see N73-16169 07-09)
Copyright.

Stability definitions and theorems in the sense of Liapunov are introduced for determining sufficient conditions for output stability. A technique for generating Liapunov functions for multivariable nonlinear feedback systems is reviewed; it is derived from the Kalman-Yacubovitch lemma and from Anderson's results. Finally, these concepts are applied to the study of transient power system stability; it is shown that the use of an output stability concept instead of the state stability definitions clarifies some apparent contradictions and topics of discussion of recent papers, and solves a number of conceptual problems concerning the validity of the mathematical model and the Liapunov functions used in the analysis of transient stability of power systems. Author

N73-16173 Centro Ricerca di Automatica, Milan (Italy).
STABILITY MARGINS IN THE LARGE FOR MULTIAREAS-POWER SYSTEMS
Umberto DiCaprio *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 34-50 refs (For availability see N73-16169 07-09)
Copyright.

The stability problem of an electrical power system consisting of n subsystems or areas mutually interconnected is dealt with. Specific reference was made to dangerous situations due to step type real power perturbations on each area. Each area is represented by means of an equivalent synchronous machine with a linear first order speed governor. By making use of a suitable Liapunov function; satisfactory global results are obtained both with regard to stability in the small and with regard to stability in the large. Stability conditions in the large are derived by means of a suitable parametrization of the Liapunov function in the space of perturbations (real power steps), so that the above conditions are expressed as a constraint upon maximum positive and negative values of allowable perturbations on each area. For the case of speed governors having similar transfer functions, a comparison is established with known results relative to the n-machines without damping case. It is shown that (linear first order) speed governors improve performance. Author

N73-16174 Centro Ricerca di Automatica, Milan (Italy).
A CONTRIBUTION ABOUT THE PRACTICAL APPLICATION OF POWER SYSTEM STABILITY THEORY
Fabio Saccomanno *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 51-65 refs (For availability see N73-16169 07-09)
Copyright.

A particular class of power systems, with an arbitrary number of machines, is defined, and for such class some important, strongly simplifying properties are demonstrated. In particular, the stability condition may be analytically expressed, directly depending on system parameters. An example of application for checking the dynamic security in front of a possible total load rejection, or tie-line opening, is then described, and partial and total security conditions are derived, from which the effects of any machine and network branch may be put into evidence. Finally, some necessary conditions are deduced, for replacing one or more groups of machines by suitable equivalents. Author

N73-16175 Centro Ricerca di Automatica, Milan (Italy).
STABILITY ANALYSIS OF MULTIMACHINE ELECTRICAL POWER SYSTEMS
Umbert DiCaprio and Fabio Saccomanno *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 66-80

refs (For availability see N73-16169 07-09)
Copyright.

The keeping in step of synchronous machines in power systems is considered, and a suitable mathematical model is developed. It is shown that many restrictive assumptions may be avoided so that the Liapunov method may be satisfactorily applied to a larger class of practical problems. A Liapunov function is then presented, which is especially useful for deriving a complete formulation of stability conditions of equilibrium points, and for determining the stability region corresponding to any stable equilibrium point. In this connection, a method of analysis and a numerical procedure are suggested, which include the correct identification of the stable equilibrium point around which the stability region must be evaluated. The problem of evaluating the stability region is then discussed. Author

N73-16176* Santa Clara Univ., Calif. Dept. of Electrical Engineering.
STABILITY OF LARGE-SCALE SYSTEMS
D. D. Siljak *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 81-92 refs (For availability see N73-16169 07-09)
(Grant NGR-05-017-010)
Copyright.

A survey is presented of the results obtained in a stability study of large scale systems based upon the comparison principle and vector Liapunov function. Author

N73-16177* Santa Clara Univ., Calif. Dept. of Electrical Engineering.
STABILITY OF LARGE-SCALE SYSTEMS UNDER STRUCTURAL PERTURBATIONS
D. D. Siljak *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 93-104 refs (For availability see N73-16169 07-09)
(Grant NGR-05-017-010)
Copyright.

A concept of connective stability is introduced by which a large-scale system is regarded as stable if it remains stable (in the sense of Liapunov) under structural perturbations produced by the on-off participation of the subsystems. Algebraic conditions are developed that guarantee exponential connective stability of large scale systems which may be composed of linear and nonlinear time varying subsystems coupled by linear or nonlinear connections. Author

N73-16178* Santa Clara Univ., Calif. Dept. of Electrical Engineering.
ON STABILITY OF DISCRETE COMPOSITE SYSTEMS
Lj. T. Grujic (Belgrade Univ.) and D. D. Siljak *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1973 p 105-109 refs (For availability see N73-16169 07-09)
(Grant NGR-05-017-010)
Copyright.

Conditions are developed under which exponential stability of a composite discrete system is implied by exponential stability of its subsystems and the nature of their interactions. Stability of the system is determined by testing positive definiteness property of a real symmetric matrix the dimension of which is equal to the number of subsystems. Author

N73-16179 Mons Univ. (Belgium). Faculte Polytechnique.
ESTIMATE OF FUNCTIONALS RELATED TO DIFFERENTIAL SYSTEMS APPLICATIONS TO STABILITY
E. Carton *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 110-115 refs (For availability see N73-16169 07-09)
Copyright.

A method is given for finding a majorizing function of a functional defined on the set of solutions of a differential system. Besides its own interest, this majorizing function can be used to prove important results about stability as it is shown by two applications. Author

N73-16180 Illinois Univ., Urbana.
A SINGULAR PERTURBATION APPROACH TO STABILITY ANALYSIS OF LARGE SCALE SYSTEMS
Petar V. Kokotovic *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 116-118 refs (For availability see N73-16169 07-09)
Copyright.

Results from a singular perturbation approach to seperate stability analysis of fast and slow parts of a large scale system are presented. Author

N73-16181 Illinois Univ., Urbana.
ON SOME APPLICATIONS OF SINGULAR PERTURBATIONS OF ORDINARY DIFFERENTIAL EQUATIONS c19
Petar V. Kokotovic *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 119-128 refs (For availability see N73-16169 07-09)
Copyright.

A tutorial introduction to singular perturbation methods and their applications to control system design. Some basic notions, such as the boundary layer system and the reduced solution, are discussed and illustrated by examples. It is shown how a simplified design of a higher order system can be improved using some lower order corrections. Author

N73-16182 Louvain Univ. (Belgium). Inst. de Mathematique Pure et Appliquee.
THE CONSISTENCY OF SINGULAR PERTURBATIONS IN SYSTEMS WITH PARASITIC ELEMENTS c19
P. Habets *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 129-134 refs Sponsored in part by CNR (For availability see N73-16169 07-09)
Copyright.

The concept of consistency of solutions to singular perturbed differential equations is introduced. Using auxiliary functions of the Liapunov type, consistency theorems were obtained that unify and generalize results. In particular, auxiliary functions related to the reduced system and the boundary layer equation were considered. Author

N73-16183 Japan Broadcasting Corp., Tokyo.
EXPERIMENTS WITH GaAs SCHOTTKY BARRIER IMPATT DIODES
Koichi Nio and Sadayuki Kadoo Sep. 1972 8 p refs
(NHK-Labs-Note-156) Copyright. Avail: Issuing Activity

The IMPATT mode, can take place in several varieties of diode doping profile. Simple pn junction type IMPATT diodes are the solid state devices used throughout the microwave frequency range. However, fabrication of junction type diodes for millimeter waves is very difficult because dc input power density is high. Transition from one kind of doping to another is abrupt, and the active layer is thin. The fabrication and performance of the Schottky barrier IMPATT diode in the frequency range of 20 to 30 GHz are described. Author

N73-16184 Rhode Island Univ., Kingston.
AN INVESTIGATION OF THE DIPOLE ANTENNA OVER STATIONARY AND TIME VARYING IRREGULAR SURFACES Ph.D. Thesis
Dennis Eisnor Fessenden 1971 122 p
Avail: Univ. Microfilms Order No. 72-9792

Electromagnetic scattering from rough surfaces is studied for the case of a dipole antenna illuminating an ocean surface with spherical waves. Fluctuations in the fast electric field intensity caused by reinforcement and cancellation of the direct wave by the wave reflected from a time-varying surface are considered. Various models of the ocean surface are formulated and it is shown that widest field variation occurs in the direction broadside to the direction of wave motion. Field variation usually disappears when free space wavelength becomes equal to or greater than twice the wavelength of the surface. Dissert. Abstr.

N73-16185*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRA-STABLE OSCILLATOR Patent Application
Leonard L. Kleinberg, inventor (to NASA) Filed 14 Dec. 1972 17 p
(NASA-Case-GSC-11513-1; US-Patent-Appl-SN-315069) Avail: NTIS HC $3.00 CSCL 09E

A high frequency oscillator, having both good short and long term stability, is formed by including a piezoelectric crystal in the base circuit of a first bi-polar transistor circuit, the bi-polar

transistor itself operated below its transitional frequency and having its emitter load chosen so that the input impedance, looking into the base thereof, exhibits a negative resistance in parallel with a capacitive reactance. Combined with this basic circuit is an auxiliary second bi-polar transistor circuit. By this configuration, variations in the input impedance of the first bi-polar transistor are substantially cancelled thereby achieving from the oscillator a signal having its frequency of oscillation stable over long time periods as well as short time periods. NASA

N73-16186*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HYPERVELOCITY IMPACT TESTING OF CABLES
David W. Jex, Albert B. Adkinson, James E. English, and Carl E. Linebaugh Washington Feb. 1973 58 p refs
(NASA-TN-D-7178; M-450) Avail: NTIS HC $3.00 CSCL 09A

The physics and electrical results obtained from simulated micrometeoroid testing of certain Skylab cables are presented. The test procedure, electrical circuits, test equipment, and cable types utilized are also explained. Author

N73-16187*# Radio Corp. of America, Princeton, N.J.
TWO-PHASE CHARGE-COUPLED DEVICE Final Report, 25 Jun. - 24 Dec. 1971
W. F. Kosonocky and J. E. Carnes Washington NASA Jan. 1973 106 p refs
(Contract NAS1-10983)
(NASA-CR-2148; PRRL-72-CR-6) Avail: NTIS HC $3.00 CSCL 09A

A charge-transfer efficiency of 99.99% per stage was achieved in the fat-zero mode of operation of 64- and 128-stage two-phase charge-coupled shift registers at 1.0-MHz clock frequency. The experimental two-phase charge-coupled shift registers were constructed in the form of polysilicon gates overlapped by aluminum gates. The unidirectional signal flow was accomplished by using n-type substrates with 0.5 to 1.0 ohm-cm resistivity in conjunction with a channel oxide thickness of 1000 A for the polysilicon gates and 3000 A for the aluminum gates. The operation of the tested shift registers with fat zero is in good agreement with the free-charge transfer characteristics expected for the tested structures. The charge-transfer losses observed when operating the experimental shift registers without the fat zero are attributed to fast interface state trapping. The analytical part of the report contains a review backed up by an extensive appendix of the free-charge transfer characteristics of CCD's in terms of thermal diffusion, self-induced drift, and fringing field drift. Also, a model was developed for the charge-transfer losses resulting from charge trapping by fast interface states. The proposed model was verified by the operation of the experimental two-phase charge-coupled shift registers. Author

N73-16188# California Univ., Berkeley. Lawrence Berkeley Lab.
USE OF SCATTERING PARAMETERS IN THE DESIGN OF AMPLIFIERS OF SUBNANOSECOND RISETIME M.S. Thesis
Rosser S. Wilson Feb. 1972 167 p refs
(Contract W-7405-eng-48)
(LBL-772) Avail: NTIS

Techniques useful in the design of wideband linear amplifiers intended for pulse operation are discussed. A suitable model for high frequency transistors is given, and use is made of the scattering characterization and of a special computer program to deduce element values in the model. The design of a fast risetime series-shunt pair and series-series triple is carried out, and computer simulations are used to predict performance of the actual designs inclusive of all parasitic reactances consequent upon physical realization of the circuit. Author (NSA)

N73-16189# Bendix Corp., Kansas City, Mo.
FABRICATION OF MULTILAYER PRINTED WIRING BOARDS Interim Report
M. L. Wilson Sep. 1972 68 p refs
(Contract AT(29-1)-613; Bendix Order 6984269)
(BDX-613-382-Rev) Avail: NTIS

The establishment of production capability for high quality multilayer printed wiring boards is discussed. This capability was established by determining the current state-of-the art in the printed circuit industry as related to multilayer circuit boards, refining and adapting the processes which were directly related, and establishing new and unique processes for precision multilayer printed wiring board fabrication. The areas investigated included lamination processes, epoxy etchback processes, and materials. Tests were made and data were collected to evaluate the effectiveness of the selected processes and to eliminate initial process prove-in problem areas. Author

N73-16190# Sandia Labs., Albuquerque, N.Mex.
NEUTRON IRRADIATION EFFECTS ON MICROWAVE TRANSISTOR AMPLIFIERS
J. G. Webb and R. J. Chaffin Aug. 1972 6 p refs Sponsored by AEC
(SC-R-72-2845) Avail: NTIS

The effect of neutron fluence on the noise performance, power gain, and power output of microwave bipolar transistor amplifiers was studied. Low noise, small signal amplifiers and high efficiency, high power amplifiers were studied. It was found that microwave bipolar transistors are fairly insensitive to neutron damage in both low noise and high power applications and useful amplifier performance beyond ten to the 15th power nvt can be obtained. NSA

N73-16191# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
STUDY OF THE INFLUENCE OF NANOELECTRONIC TECHNOLOGY ON THE DEVELOPMENT AND PERFORMANCE OF RAPID LOGIC CIRCUITS USING LITTLE POWER Final report [ETUDE DE L'INFLUENCE DES TECHNOLOGIES 'NANOELECTRONIQUE' SUR LA CONCEPTION ET LES PERFORMANCES DES CIRCUITS LOGIQUES RAPIDES A FAIBLE CONSOMMATION]
R. Lyon-Caen [1971] 129 p In FRENCH
(Contract Del-Inf-70.80.038.00.212.75.01)
Avail: NTIS HC $8.50

The program AFLOU for the calculation of FET characteristics is described and applied to calculation of the resistance. Two types of resistance samples were designed, the first for high frequency simulation studies, the second for analysis of resistance dispersion and other resistance variations. The delays due to ionization and deionization of zener diodes are evaluated. ESRO

N73-16192# Laboratoire Central de Recherches Thomson-CSF, Orsay (France). Dept. Microelectronique Hyperfrequence.
STUDY OF GALLIUM ARSENIDE VARACTOR DIODES AND SCHOTTKY DIODES FOR USE AT 20 AND 30 GHz [ETUDE DE DIODES VARACTORS ET DE DIODES SCHOTTKY A L'ARSENIURE DE GALLIUM POUR UTILISATION A 20 ET 30 GHz]
P. Gibeau 7 Apr. 1971 66 p In FRENCH
(Contract CNES-69.267)
Avail: NTIS HC $5.50

Gallium arsenide varactors and diodes to be used in a frequency multiplier for an oscillator operating at 20 and 30 GHz were investigated. The choice of gallium arsenide and epitaxial structure is discussed, as well as the diode geometry. A theoretical study to optimize the quality of the material and the geometrical parameters of the diode is presented. It is concluded that devices giving an output power above 40 mW were obtained due to improvement of the epitaxial material and to techniques which preserved the initial material qualities. Some solutions are proposed to reduce the cost of diodes. ESRO

N73-16193# Northrop Corp., Palos Verdes Estates, Calif. Electronics Div.
DIGITAL ADDRESS THIN DISPLAY TUBE Quarterly Report, 15 Feb. - 15 May 1972
Walter F. Goede Nov. 1972 30 p refs
(Contract DAAB07-72-C-0076; DA Proj. 1S6-62705-A-00503)
(AD-751745; NORT-72-280-1; QR-1; ECOM-0076-1) Avail: NTIS CSCL 09/1

The report describes the progress which occurred during the first quarter of a Research and Development contract to develop a 512x512 resolution element display with a resolution of 55 holes per inch. This digitally addressed thin display tube is being designed to evaluate and demonstrate the feasibility of

using this display concept to meet Army requirements for a computer output display. During this first quarter the display design (including switching plate design) was completed, cathode testing was initiated, a preliminary envelope configuration was generated, and the interface design was completed. In addition, a design was completed for a 160x256 resolution element device at 55 holes per inch. This device will be used to extrapolate to the performance of the 512x512 display, and to test the design philosophy. This smaller device will serve as a valuable aid in pinpointing possible problem areas much earlier in the program, allowing time for design modifications. Author (GRA)

N73-16194# Army Electronics Command, Fort Monmouth, N.J.
HIGH POWER S-BAND JUNCTION CIRCULATOR
R. A. Stern Fort Monmouth, N. J. ECOM Sep. 1972 15 p refs
(DA Proj. 1S6-62703-A-057)
(AD-751743; ECOM-4025) Avail: NTIS CSCL 09/1

The design of a high-power air-cooled microwave Y junction circulator which is capable of operation at peak and average power levels of 800 kW and 800 W, respectively, is described. The unit is an H-plane waveguide circulator which is externally air cooled. The circulator design employs a full height substituted YIG rod together with boron nitride matching transformers. Author (GRA)

N73-16195# Princeton Univ., N.J. Solid State and Materials Lab.
THE TRAP STRUCTURE OF PYROLYTIC Al2O3 IN MOS CAPACITORS
E. Harari and B. S. H. Royce 15 Nov. 1972 11 p refs
(Contract N00014-67-Z-0151-0026)
(AD-751629; PSSL-141172) Avail: NTIS CSCL 09/1

The trap structure of the pyrolytic Al2O3 layer of MOS capacitors was investigated by a technique in which the capacitor was used as an integral detector of the charge trapped in the oxide. In all the samples studied, five trap levels were found to exist extending from 2.2 eV to 4.5 eV below the oxide conduction band. The spatial distribution of these traps was inferred from complementary photoconductivity measurements. This method is applicable to the study of the effects of radiation damage and ion implantation on the trap structure of this and other thin film insulators. Author (GRA)

N73-16196# Naval Postgraduate School, Monterey, Calif.
SLOT TRANSMISSION LINE M.S. Thesis
John Leslie Zavadil Dec. 1971 36 p refs
(AD-751657) Avail: NTIS CSCL 09/1

A slot transmission line on a dielectric substrate has been proposed as an alternative to open microstrip line as a transmission line for microwave integrated circuits. Construction and measurement techniques suitable for this configuration are described. Experimental measurements of slot line parameters and a coaxial line-to-slot line transition from 10 MHz to 12 GHz are discussed. Insertion loss of a 2 inch length of slot line with coaxial transitions was found to be less than 5 dB from 400 MHz to 6 GHz, and the input VSWR was less than 2.0 from 1 GHz to 10 GHz. Author (GRA)

N73-16197# Naval Postgraduate School, Monterey, Calif.
PARAMETRIC AMPLIFIER INPUT NOISE TEMPERATURE DEGRADATION CAUSED BY AN INTERFERING SIGNAL IN OR NEAR THE PARAMP PASSBAND M.S. Thesis
William Standish Phillips Jun. 1972 51 p refs
(AD-751652) Avail: NTIS CSCL 09/5

The dependence of the input noise temperature of a parametric amplifier upon the pump source AM noise level, when a strong interfering signal is present in or near the paramp passband, is examined both theoretically and experimentally. An equation has been derived that predicts a contribution to the paramp input noise temperature which is linearly proportional to interfering signal power, paramp gain, and pump AM noise level. Experimental verification was achieved in comparison of various klystron, gunn, and impatt oscillator pumps exciting a typical military satellite communication receiver paramp. Author (GRA)

N73-16198# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ANTENNA WITH A CONTROLLABLE RADIATION PATTERN IN A HORIZONTAL PLANE
A. I. Filatov and A. S. Belynskii 20 Oct. 1972 12 p refs
Transl. into ENGLISH from Tr. Uralskii no. 183, 1970 p 25-29
(AD-751449; FTD-HT-23-1354-72) Avail: NTIS CSCL 09/5

The authors describe an antenna for the 3-cm band in the form of a radial waveguide which passes into a biconical horn and is excited at the center by a circular waveguide which is matched to the radial waveguide by three cylinders coaxial with it. The radiation pattern is controlled by means of an electrically controllable polarizer which consists of two ferrite rotators of the polarization plane separated by a 1/4-wave plate of polystyrene, and a matched converter. GRA

N73-16199# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.
A COMPUTER MODEL FOR RAPID SOLUTIONS AND VISUAL CRT DISPLAY OF RADIATION PATTERNS FOR ARBITRARILY ORIENTABLE YAGI-UDA ARRAYS OPERATING OVER LOSSY GROUND OR IN SHIP-OCEAN ENVIRONMENTS M.S. Thesis
Edward Elvis Kennedy Jun. 1972 130 p refs
(AD-751658) Avail: NTIS CSCL 09/5

An arbitrarily orientable Yagi-Uda array antenna was modeled, and a computer simulation run to obtain the input impedance, gain pattern and front-to-back ratio of various arrays. The model made provisions for the antenna to be operated over either a lossy ground plane or aboard a ship in seas of specified state. Quick solution turn-around, with CRT display, enabled relatively rapid optimization of numerous arrays. Theory, resultant optimal designs and performances, photographs, and program listing are included. Author (GRA)

N73-16200# Varian Associates, Palo Alto, Calif.
DEVELOPMENT OF A BROADBAND S-BAND AMPLIFIER Final Report
A. D. LaRue Griffiss AFB, N. Y. RADC Oct. 1972 75 p refs
(Contract AF 30(602)-4351; AF Proj. 4506)
(AD-751262; RADC-TR-72-258) Avail: NTIS CSCL 09/1

The report covers development of the VA-915A Twystron hybrid traveling wave tube and construction and test of four models of the tube. The major subassemblies of the VA-915A are discussed in some detail. In particular, the report covers: Electron gun; Multicavity broadband klystron assembly; Centipede TWT RF output assembly; RF output window; Collector; Electromagnet. Author (GRA)

N73-16201# Hebrew Univ., Jerusalem (Israel).
STUDIES OF PHOTO INDUCED TUNNEL CURRENTS IN Al-Al2O3-Au STRUCTURES Final Technical Report, Jul. 1971 - Jun. 1972
Z. Burshtein, J. Levinson, and A. Many Aug. 1972 28 p refs
(Contract DAJA37-72-C-0487; DA Proj. 200-61102-B-31E)
(AD-751758; ARDG(E)-E-1437) Avail: NTIS CSCL 09/1

The work describes the study of tunnel-diodes of the metal-insulator-metal structure based on measurements of the photo-induced tunnel current (PITC). Effort provided a series of measurements on Al-Al2O3-Au tunnel diodes that included PITC as well as I-V and internal photo-emission measurements. A simplified model is presented from which a theoretical expression for the PITC can be derived. It is shown that the experimental results are in a fairly good agreement with the theory. The potential barriers at the Al-Al2O3 and Au-Al2O3 interfaces were deduced to be 2.0 and 4.35 ev. The cross-section for photo-generation of electrons in the aluminum metal was estimated as 10 to the minus 16th power sq cm. It is also shown that electron reflection at the metal-oxide interfaces and/or scattering in the Al2O3 layer are quite important, possibly reducing the current by as much as two orders of magnitude. Author (GRA)

N73-16202# Avco Corp., Wilmington, Mass. Systems Div.
MICROWAVE BREAKDOWN IN THE FRINGING FIELD OF A RECTANGULAR SLOT ANTENNA Interim Report
Jerrold M. Yos 23 Jun. 1972 43 p refs
(Contract F19628-72-C-0102; AF Proj. 4642)
(AD-751320; AVSD-0360-72-CR; AFCRL-72-0486; SR-1)
Avail: NTIS CSCL 09/5

A simple mathematical model is developed to predict breakdown in the fringing field of a rectangular aperture antenna in a ground plane. Approximate criteria for the applicability of this model are given and the predictions are compared with previous theory and with experiment. Author (GRA)

N73-16203# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Microwave Physics Lab.
ARRAY TECHNIQUES FOR LIMITED SCAN APPLICATION
Robert J. Mailloux 19 Jul. 1972 74 p refs
(AF Proj. 4600)
(AD-751274; AFCRL-72-0421; AFCRL-PSRP-503) Avail: NTIS CSCL 09/5

A variety of techniques are described which allow the use of large array elements or sub-arrays for limited scan application. Some of these techniques are new and so are described in sufficient detail to predict their performance. Emphasis is placed mainly on the method called odd-mode-scanning; the treatment of other techniques are included to add background for evaluating this new method. Author (GRA)

N73-16204# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TWO-CAVITY KLYSTRON PARAMETER OPTIMIZATION
K. P. Burneika and V. I. Kanavets 15 Sep. 1972 14 p refs
Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (USSR), v. 12, 1969 p 1018-1022
(AD-751073; FTD-HT-23-1196-72) Avail: NTIS CSCL 09/1

The report presents an analysis of electron bunching in the drift area of powerful two-cavity klystrons via one-dimensional approximation using an electron beam disk model over a wide range of beam parameter variation. It has been shown that in a certain region of space charge parameter variation the consideration of nonlinear effects associated with Coulomb forces leads to improved characteristics of the buncher, an additional increase in the first current harmonic, a decrease in the electron velocity spread, and improved quality function. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-16205* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA-AIDED CARRIER TRACKING LOOPS Patent
William C. Lindsey and Marvin K. Simon, inventors (to NASA) Issued 9 Jan. 1973 6 p Filed 24 Dec. 1970 Supersedes N71-33105 (09 - 20, p 3242) Sponsored by NASA
(NASA-Case-NPO-11282; US-Patent-3,710,261; US-Patent-Appl-SN-101354; US-Patent-Class-325-346; US-Patent-Class-325-419) Avail: US Patent Office CSCL 09C

The characteristics of a data-aided carrier tracking loop are discussed. The loop signal to noise ratio is improved in a phase-locked loop used for tracking a carrier an angle modulated communications system by a quadrature channel added to the phase locked loop. A d.c. signal derived from the quadrature channel is added to the signal fed back to the voltage controlled oscillator in the otherwise conventional phase-locked loop.
Official Gazette of the U.S. Patent Office

N73-16206* National Aeronautics and Space Administration. Pasadena Office, Calif.
PHASE CONTROL CIRCUITS USING FREQUENCY MULTIPLICATIONS FOR PHASED ARRAY ANTENNAS Patent
Robert J. Mailloux and Paul R. Caron, inventors (to NASA) Issued 9 Jan. 1973 13 p Filed 16 Jul. 1970 Supersedes N70-36076 (08 - 19, p 3518)
(NASA-Case-ERC-10285; US-Patent-3,710,329; US-Patent-Appl-SN-55333; US-Patent-Class-343-100SA; US-Patent-Class-331-45; US-Patent-Class-343-100R; US-Patent-Class-343-853) Avail: US Patent Office CSCL 09C

A phase control coupling circuit for use with a phased array antenna is described. The coupling circuit includes a combining circuit which is coupled to a transmission line, a frequency multiplier circuit which is coupled to the combining circuit, and a recombining circuit which is coupled between the frequency multiplier circuit and phased array antenna elements. In a doubler embodiment, the frequency multiplier circuit comprises frequency doublers and the combining and recombining circuits comprise four-port hybrid power dividers. In a generalized embodiment, the multiplier circuit comprises frequency multiplier elements which multiply to the Nth power, the combining circuit comprises four-part hybrid power dividers, and the recombinding circuit comprises summing circuits.
Official Gazette of the U.S. Patent Office

N73-16207 Brown Univ., Providence, R.I.
DESIGN CONSIDERATIONS OF A PARAMETER ADAPTIVE CONTROL ALGORITHM Ph.D. Thesis
Krishna-Sastry Venkata Rama Vanguri 1971 143 p
Avail: Univ. Microfilms Order No. 72-8195

An algorithm for choosing the adaptive loop parameters for the synthesis of parameter adaptive control systems was developed. The algorithm permits an effective implementation of a modified gradient scheme for closed-loop adaptation, by making discrete-time adjustments in the controller parameters of a basic control system, in order to compensate for the drift variations in the plant parameters. The synthesis procedure involves structuring the basic control system such that model matching is possible. The performance index used is the integral squared error, which has the properties of a metric function, when certain operating conditions are upheld. These conditions include the resetting of the initial conditions in the model to those of the basic control system at the start of each adjustment interval. The algorithm requires only first order sensitivity functions for choosing the crucial adaptive loop gains and adjustment intervals, and can be implemented on-line in real time using standard analog or hybrid logic. Dissert. Abstr.

N73-16208*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RELIABILITY OF HYBRID MICROCIRCUIT DISCRETE COMPONENTS
Robert V. Allen Oct. 1972 33 p Revised Previously announced as NASA-TM-X-64686; N72-31275
(NASA-TM-X-64686) Avail: NTIS HC $3.75 CSCL 09C

Data accumulated during 4 years of research and evaluation of ceramic chip capacitors, ceramic carrier mounted active devices, beam-lead transistors, and chip resistors are presented. Life and temperature coefficient test data, and optical and scanning electron microscope photographs of device failures are presented and the failure modes are described. Particular interest is given to discrete component qualification, power burn-in, and procedures for testing and screening discrete components. Burn-in requirements and test data will be given in support of 100 percent burn-in policy on all NASA flight programs. Author

N73-16209# California Univ., Livermore. Lawrence Livermore Lab.
DUAL GRID CHARACTERISTIC METHOD FOR THE NUMERICAL INTEGRATION OF THE THREE-WIRE TRANSMISSION LINE EQUATIONS
K. S. Yee (Kans. State Univ.), D. C. Oakley, and J. P. Woodruff 22 Jun. 1972 44 p refs Presented at IEEE Ann. Conf. on Nucl. and Space Radiation Effects, Seattle, 24-27 Jul. 1972 Sponsored by AEC
(UCRL-73796; Conf-720707-11) Avail: NTIS

A method for the numerical solution of the system of hyperbolic equations that arise from the study of signal propagation on a three-wire transmission line is reported. This method solves the characteristic forms of the equations by using a distinct spatial grid for each traveling wave. The resulting computer code produces calculations that are virtually free of numerical dispersions. Author

N73-16210# Stanford Research Inst., Menlo Park, Calif.
MICROWAVE NETWORK SYNTHESIS Semiannual Report, 1 Feb. - 31 Jul. 1972
Robert E. Lee, Alfred J. Bahr, and Edward G. Cristal Nov. 1972 108 p refs
(Contract DAAB07-72-C-0127; SRI Proj. 1679)

(AD-751746; ECOM-0127-S) Avail: NTIS CSCL 09/1

The results of a theoretical and experimental study of the grating transducer are presented. The results clearly demonstrate that such a structure can couple effectively to surface acoustic waves. However the study has revealed two problem areas: (1) It is difficult to prevent the parasitic capacitance to ground from dominating the electrical behavior of such transducers, and (2) the electric fields that jump over between nonadjacent electrodes can couple to surface waves (and bulk waves) and therefore must be taken into account in a transducer design. A possible method for improving the transducer design is discussed. A compact channel-dropping-filter geometry consisting of hairpin bandpass and folded-line bandstop filters is proposed for stripline and MIC (microwave integrated circuits). Design details and theoretical and experimental data for a trial channel-dropping filter are presented. Author (GRA)

N73-16211# International Business Machines Corp., Owego, N.Y. Electronic System Center.

SCEPTRE SUPPORT 2. VOLUME 1: REVISED USER'S MANUAL (SUPPLEMENT) Final Report, 15 Apr. 1970 - 1 Jul. 1972

Stephen R. Sedore and Allen I. Wright Kirtland AFB, N. Mex. AFWL Sep. 1972 61 p refs

(Contract F29601-70-C-0038; AF Proj. 5710)

(AD-751518; AFWL-TR-69-77-Vol-1-Suppl) Avail: NTIS CSCL 09/1

The report is intended to serve as a supplement to the SCEPTRE User's Manual, AFWL-TR-69-77, Volume I, and also as a final report for Contract F29601-70-C-0038. The content of section 2 should be considered as additions to the existing manual, while section 3 contains information to replace cited portions of the manual. The remainder is the final report that describes in detail the improvements to the program that were added during the contract period. Author (GRA)

N73-16212# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.

THE 1972 GOVERNMENT MICROCIRCUIT APPLICATIONS CONFERENCE (GOMAC): DIGEST OF TECHNICAL PAPERS

Oct. 1972 445 p refs Proc. of conf. held at San Diego, Calif., 10-12 Oct. 1972

(AD-751316; AFAL-TR-72-354) Avail: NTIS CSCL 09/5

Contents: Surface acoustics; Microcircuit packaging; Optoelectronics; Radiation hardening; Digital circuits and systems; Hybrid microelectronics; New solid state devices, Microwave integrated circuit systems; Linear integrated circuits; Microcircuit processing and integrated circuit techniques; Microwave integrated circuits; Microelectronic memories. GRA

N73-16213# International Business Machines Corp., Owego, N.Y. Electronics System Center.

MATHEMATICAL FORMULATION OF SCEPTRE Technical Report, 15 Apr. 1970 - 1 Jul. 1972

Stephen R. Sedore and John R. Sents Kirtland AFB, N. Mex. AFWL Sep. 1972 70 p refs

(Contract F29601-70-C-0038; AF Proj. 5710)

(AD-751519; AFWL-TR-72-77) Avail: NTIS CSCL 09/5

SCEPTRE is a general DC and transient analysis FORTRAN 4 program with a capability for handling radiation effects circuit analysis problems. The report contains the theory and formulation that provides a basis for SCEPTRE and a description including flow diagrams of the program operation. Author (GRA)

N73-16214# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE POSSIBILITY OF USING LIQUID DISCHARGERS IN HIGH VOLTAGE NANOSECOND PULSE CIRCUITS

G. A. Mesyats and G. A. Vorobev 8 Sep. 1972 11 p ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Fiz. (USSR), no. 3, 1962 p 21-23

(AD-751170; FTD-HT-23-939-72) Avail: NTIS CSCL 09/5

The article compares the commutation time t sub k of air and oil dischargers and shows that in the latter t sub k is less. It is also found that the durability of the oil during short pulses does not depend on its humidity. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-16215 Texas Univ., Austin.

THEORETICAL EFFECTS OF POROSITY AND ANGLE OF ATTACK ON JET STRETCHER PERFORMANCE Ph.D. Thesis

Ben Russell Eppright, Jr. 1971 117 p

Avail: Univ. Microfilms Order No. 72-11341

Two methods of improving the usefulness of a jet stretcher are investigated. Both methods attempt to make possible the use of a jet stretcher designed for a body at zero angle of attack with the same body at small angles of attack. The two methods are: (1) making the jet stretcher walls porous, and (2) placing the jet stretcher at an angle of attack. The above methods are investigated theoretically by solving the supersonic, three-dimensional flow field about the body with the jet stretcher and without the jet stretcher. The solutions are obtained numerically using the Method of Characteristics for an ideal, inviscid gas. The derivation of the finite difference equations is included. The results are first compared to experimental data to establish the accuracy of the solution. It is found that the solution is very accurate. The solutions for the body with the jet stretcher are then compared to the solutions for the body without the jet stretcher. Dissert. Abstr.

N73-16216 Stanford Univ., Calif.

MODELING OF A SATELLITE AIRPORT SYSTEM FOR LARGE METROPOLITAN AREAS: A SYSTEMS ANALYSIS Ph.D. Thesis

Inder Kumar Sud 1971 195 p

Avail: Univ. Microfilms Order No. 72-11674

The satellite airport system is presented as a possible solution to the growing congestion problem at the major metropolitan airports. The system visualizes a large airport as the hub of a ring of satellites around it. The satellite airport system includes conventional take-off and landing (CTOL) airports, short take-off and landing (STOL) ports, and collection-ports linked to the main airport by means of transportation links. It is proposed that the short-haul and some of the medium-haul passengers would be handled by the satellite airports and the remaining passengers would enter the system at one of the satellite collection-ports, and then would be transported to the main airport. A system approach is proposed to analyze the satellite airport concept for large metropolitan areas. Various socioeconomic factors that influence the airport location are considered. A mathematical model formulates the problem as a fixed charge selection-allocation problem. Dissert. Abstr.

N73-16217*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

THE LUNAR HOPPING TRANSPORTER Final Report

R. Degner, M. Kaplan, J. Manning, R. Meetin, S. Pasternack, S. Peterson, and H. Seifert Jul. 1971 48 p refs

(Grant NGR-05-020-258)

(NASA-CR-130010; SUDAAR-428) Avail: NTIS HC $4.50 CSCL 13F

Research on several aspects of lunar transport using the hopping mode is reported. Hopping exploits the weak lunar gravity, permits fuel economy because of partial recompression of propellant gas on landing, and does not require a continuous smooth surface for operation. Three questions critical to the design of a lunar hopping vehicle are addressed directly in this report: (1) the tolerance of a human pilot for repeated accelerations; (2) means for controlling vehicle attitude during ballistic flight; and (3) means of propulsion. In addition, a small scale terrestrial demonstrator built to confirm feasibility of the proposed operational mode is described, along with results of preliminary study of unmanned hoppers for moon exploration. Author

N73-16218*# System Development Corp., Santa Monica, Calif.

IMPROVEMENTS TO INFORMATION MANAGEMENT

SYSTEMS SIMULATOR Final Report
R. W. Bilek 10 Nov. 1972 30 p
(Contract NAS9-12871)
(NASA-CR-128718; TM-5019) Avail: NTIS HC 05b

The performance of personnel in the augmentation and improvement of the interactive IMSIM information management simulation model is summarized. With this augmented model, NASA now has even greater capabilities for the simulation of computer system configurations, data processing loads imposed on these configurations, and executive software to control system operations. Through these simulations, NASA has an extremely cost effective capability for the design and analysis of computer-based data management systems. Author

N73-16219*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RECOMMENDATIONS RELATIVE TO THE SCIENTIFIC MISSIONS OF A MARS AUTOMATED ROVING VEHICLE (MARV)
Robert L. Spencer, ed. Jan. 1973 64 p
(NASA-TM-X-64719) Avail: NTIS HC $5.25 CSCL 13F

Scientific objectives of the MARV mission are outlined and specific science systems requirements and experimental payloads defined. All aspects of the Martian surface relative to biotic and geologic elements and those relating to geophysical and geochemical properties are explored. E.H.W.

N73-16220*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EXPERIMENT TO DETERMINE THE RELATIVE POSITIONS OF TWO COLLOCATED LASER TRACKING STATIONS
P. J. Dunn (Wolf Res. and Develop. Corp., Riverdale, Md.), R. Kolenkiewicz, and D. E. Smith Nov. 1972 14 p refs
(NASA-TM-X-66158; X-553-72-497) Avail: NTIS HC $3.00 CSCL 14B

Two Goddard Space Flight Center laser tracking stations were collocated for a short time towards the end of 1971 for the purposes of comparing their tracking performance and quality. The lasers, only 25 meters apart, obtained simultaneous tracking data on eighteen passes of the Beacon Explorer C spacecraft. These data have now been used to determine the location of one laser with respect to the other with the result that the computed position of the second laser agrees with the surveyed position to 4 centimeters in latitude and height, and 1 centimeter in longitude. Author

N73-16221*# Translation Consultants, Ltd., Arlington, Va.
THE 'ORION' ORBITAL ASTROPHYSICAL OBSERVATORY
G. A. Gurzadyan and E. A. Arutyunyan Washington' NASA Jan. 1973 9 p refs Transl. into ENGLISH from Soobshch. Byurakansk. Obs. (USSR), no. 45, 1972 p 12-19
(Contract NASw-2038)
(NASA-TT-F-14581) Avail: NTIS HC $3.00 CSCL 14N

The construction is described of the optical and kinematic parts of the astrophysical observatory Orion, installed in the orbital station Salyut. The Orion consists of a mirror telescope of the Mersenne system with a large mirror diameter of 280 mm and slitless spectrograph of the Wadsworth system with a diffraction lattice. The camera with a film gate is firmly fastened to the spectrograph, and the spectrograph is adjusted and focused by shifting the diffraction lattice. A cam mechanism imparts elastic oscillations to the diffraction grating for broadening the spectrogram up to 0.4 mm. A stellar photoguide designed to catch and guide stars up to 4 m is fastened to the body of the telescope, parallel to its optical axis. The telescope is mounted on a biaxial installation of the Cardan suspension type. The Orion is equipped with a sight system of guidance and on-board control desk with a programming device. Author

N73-16222# Landing Aids Experiment Station, Arcata, Calif.
THERMAL FOG DISPERSAL MANUAL
Dec. 1972 76 p refs Reprinted Sponsored by AF, Navy, Civil Aeron. Admin., CAB, Air Trans. Assoc., and Air Line Pilots Assoc.
(Contract C13cA-136)
(FAA-RD-72-138) Avail: NTIS HC $6.00

The requirements, basic principles of design, construction, operation, and maintenance of a thermal fog dispersal system are described. The recommended installation is a high pressure system wherein fuel is pumped to the burner lines at pressures over 1000 p.s.i., atomized by passing through an orifice plate in the burner head, and automatically ignited. Atmospheric heat requirements for the dissipation of fog, the effect of winds on system design, and the interface between aircraft and fog dispersal system operations are analyzed. Author

N73-16223# Danish Atomic Energy Commission, Risoe. Research Establishment.
IMPROVING THE MATCH BETWEEN THE MICROWAVE SOURCE AND THE MICROWAVE TRANSMISSION SYSTEM AT THE RISOE 10 MeV ELECTRON LINEAR ACCELERATOR
Joergen Fenger and Johnny Hansen Jul. 1972 31 p refs
(RISO-M-1518) Avail: AEC Depository Libraries

To achieve tolerable load conditions for the high power microwave source at the 10 MeV linear accelerator, comprehensive measurements of various parameters in the accelerator tubes and the waveguide system were carried out. Based on the measurements a modification of the parameter-defining linac components has improved the present performance and caused a higher overall efficiency. Author (NSA)

N73-16224# Federal Council for Science and Technology, Washington, D.C. Committee on Scientific and Technical Information.
MANAGEMENT OF INFORMATION ANALYSIS CENTERS
William A. Smith, ed. Jan. 1972 203 p refs Conf. held at Gaithersburg, Md., 17-19 May 1971 Sponsored by AEC and NSF
(COSATI-72-1; Conf-710550) Avail: NTIS

Three general papers were presented in session 1 on information analysis centers and automatic data processing, abstracting and indexing services, and marketing. Session 2, on automatic data processing operations and applications, includes papers on establishing a computerized file, information processing techniques for small semi-automated, scientifically-oriented data centers, user acceptance of an interactive retrieval system, inputting techniques, and computer usage in a larger data center. The third session, on abstracting and indexing services, includes case studies of ERIC/CLIS and the Air Force Machinability Center, the role of secondary services, a profile of scientific-technical tape information services, NSIC computerized information techniques, and the trends in services. Session 4, marketing, includes case studies of DoD, Copper Data Center, Plastics Technical Evaluation Center, and information analysis centers' liaison with professional organizations, commercial firms, and the private sector. Author

N73-16225# Institut Franco-Allemand de Recherches, St. Louis (France).
BULLET RIFLING MEASUREMENTS USING POLARIZED LIGHT [GESCHOSSDRALLMESSUNG MIT POLARISIERTEM LICHT]
R. Meyer and A. Stenzel Bonn Bundeswehramt 1972 30 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-72-18; ISL-T-25/70) Avail: NTIS HC $3.50; Bundeswehramt 25 DM

A technique is described for measuring the rotation of a projectile by means of polarized light modulation. It is based on the optical effect obtained by modulating the intensity of a linearly polarized light beam by the motion of a polarization filter rotating with respect to the direction of polarization. The nose of the projectile was equipped with a small reflector made by superposing a polarization foil and a totally reflecting foil. Incident laser light undergoes an intensity modulation, which is recorded by a detector. The modulation frequency equals the double rotation frequency of the projectile. Measurements performed with load bullets fired from air guns and with conventional infantry ammunition have confirmed the applicability of this technique. ESRO

N73-16226# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
NONLINEAR AND FINITE PAD LENGTH PERFORMANCE OF VEHICLE AIR CUSHION SUSPENSIONS
D. N. Wormley, D. P. Garg, and A. B. Boghani Feb. 1972 130 p refs
(Contract DOT-FR-10007)
(PB-212705; EPL-72-72966-1; FRA-RT-73-6) Avail: NTIS HC $3.00 CSCL 13B

Nonlinear and small perturbation linear models for the one-dimensional heave motion of a basic flexible-skirted air cushion suspension are formulated. A study of linear and nonlinear model characteristics under transient guideway and external force inputs is conducted to determine over what range of cushion configurations, operating conditions, and input disturbance levels a linear model provides a good approximation to the nonlinear cushion model. The performance of a finite pad length suspension on a guideway containing random irregularities is determined. To illustrate the design information resulting from the transient performance and finite pad length study, the prototype designs of suspensions for intraurban and intercity vehicles are discussed. Author (GRA)

N73-16227# Physics International Co., San Leandro, Calif.
DEVELOPMENT OF AN ADVANCED PULSED ELECTRON BEAM ACCELERATOR Final Report, Jan. - Aug. 1971
P. Champney, G. L. Hatch, K. Nielsen, S. Shope, and I. Smith Oct. 1972 97 p refs
(Contract DASA01-70-C-0063; DNA Proj. NWEL-A013)
(AD-751593; PIFR-226; DNA-2864F) Avail: NTIS CSCL 20/7

The report covers the development of a 50-kJ generator capable of producing currents in excess of one megampere at voltages approaching one megavolt with a pulse width about 55 nsec. The concept is to feed an electron accelerating tube from two modules, each containing multiple Mylar striplines arranged in a series-parallel configuration. Each module contains 8 Blumleins with a total output of 0.5 MA to 1 MV. The modular concept permits the individual Mylar lines to be assembled in air and vacuum-impregnated with copper sulphate solution. The module and its striplines are easily attached to the accelerating tube. Additional modules can be added to the present design to increase the machine power output. Author (GRA)

N73-16228# Naval Training Equipment Center, Orlando, Fla. Visual Simulation Lab.
LARGE-SCREEN TACTICAL DISPLAY SYSTEMS FOR TRAINING DEVICES Final Report, Jan. - Jun. 1972
Edward F. Kashork 18 Oct. 1972 34 p refs
(AD-751559; NAVTRAEQUIPCEN-IH-213) Avail: NTIS CSCL 14/2

To provide a solution to the problem of tactical displays in training devices, a study was made of several large-screen display systems not known to be used in training devices, and a state-of-the-art review performed for possible short-and long-term solutions. From the present projection system, an objective performance specification for a large-screen display was developed and the data compared to determine replacement system or systems. Of the seven major systems reviewed and compared to the specification, only three met the requirements: PC/CRT/film, PC/CRT/glass and PC/laser/film; with a fourth (PC/laser/glass) that could be added although not in development. Both CRT and laser systems could serve as short-term solutions; however, since the laser systems are not fully proven and were rejected in a previous study, it was concluded that the CRT should be the medium used. Author (GRA)

N73-16229# Naval Postgraduate School, Monterey, Calif.
IMPLEMENTATION OF A FIXED BASE SPIN SIMULATOR M.S. Thesis
Bruce Holladay Kenton Sep. 1972 139 p refs
(AD-751644) Avail: NTIS CSCL 14/2

The report discusses the design and implementation of a fixed-based spin simulator and the results derived from conducting preliminary spin tests on the simulator. The central piece of equipment in the simulator was a hybrid computer in which the analog computer solved the equations of motion while the digital computer performed the tasks of program control and aerodynamic data storage. The visual display consisted of a computer-drawn picture on a graphics terminal, while pilot control was obtained by use of a simulated cockpit situated in front of the graphics terminal. Author (GRA)

N73-16230# Naval Research Lab., Washington, D.C. Cyclotron Branch.
REPORT OF CYCLOTRON OPERATION Interim Report, 1 Jan. - 31 Dec. 1971
Oct. 1972 56 p refs
(AD-751539; NRL-MR-2518) Avail: NTIS CSCL 20/7

Contents: Basic research program - Few-nucleon systems; Light nuclei; Deformed nuclei; Direct reactions; Alpha scattering; Applications research program - Helium implantation; Trace assay; Radioisotope production; Neutron radiotherapy; Space applications; The data acquisition system. GRA

N73-16231# Picatinny Arsenal, Dover, N.J.
EXPERIMENTAL EVALUATION OF TRACK ACCELERATOR CONCEPT FOR MISSILE FLIGHT SIMULATION Technical Memorandum on Phase 1, Apr. - Nov. 1971
Joseph G. Cappetta and Steven H. Langdo Aug. 1972 52 p
(AD-751128; PA-TM-2049) Avail: NTIS CSCL 14/2

The report summarizes the achievements and findings resulting from the Phase I effort to experimentally evaluate the feasibility of a missile acceleration simulator based upon the Track Accelerator (TA) concept. Under government contract, the Goodyear Aerospace Corporation (GAC) analyzed, designed, fabricated and tested a scaled down version of a TA, deriving sufficient information to accurately design and predict the performance characteristics of a full scale accelerator which would be capable of physically subjecting adaption kit components to simulated launch and flight acceleration-time environments. Author (GRA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-16232 Engineering Sciences Data Unit, London (England).
PRESSURE DROP IN DUCTS ACROSS ROUND WIRE GAUZES NORMAL TO THE FLOW
Jun. 1972 16 p refs Supersedes ESDU-Aero-02.00.01 Sponsored by Roy. Aeron. Soc., Inst. of Chem. Engr., Inst. of Mech. Engr., and Inst. of Structural Engr.
(ESDU-72009; ESDU-Aero-02.00.01) Copyright. Avail: Issuing Activity

The pressure drop in ducts across round-wire gauzes normal to a fluid flow is discussed. The pressure drop is dependent upon the gauze geometry, and the velocity, density, Reynold's number and Mach number of the flow. The effects of porosity, velocity profile, and mesh form are also considered. Mathematical models are included to amplify the theoretical aspects. Author

N73-16233 Engineering Sciences Data Unit, London (England).
ONE DIMENSIONAL ISENTROPIC FLOW OF A THERMALLY PERFECT, CALORICALLY IMPERFECT DIATOMIC GAS
1971 11 p refs Sponsored by Royal Aeron. Soc.
(ESDU-S.00.01.10-Amend-A) Copyright. Avail: Issuing Activity

A numerical analysis of one-dimensional isentropic flow of a thermally perfect, calorically imperfect diatomic gas is presented. Mathematical models are presented to describe the equation of state for a thermally perfect gas, the momentum equation, and the energy equation. Specific application of the numerical procedures for wind tunnel conditions is included. Author

N73-16234 Stanford Univ., Calif.
ON OPTIMAL COORDINATES AND BOUNDARY LAYER THEORY Ph.D. Thesis
Hartmut Hans Legner 1971 159 p
Avail: Univ. Microfilms Order No. 72-11599

Saul Kaplun's unique (1954) paper describing the optimal

coordinates of boundary-layer theory is re-examined, extended, and re-vitalized. The focus of the present analysis is the rational generalization of his basic results to higher-order boundary-layer theory. Generalized tensor analysis and the method of matched asymptotic expansions are employed to develop the bare structure of a variety of boundary-layer problems using the necessary dependent variable - the stream function. The optimal coordinates, which are determined by the requirement that the boundary-layer expansion be uniformly valid (or contain the Euler expansion), are easily determined to any order using the matching principle and Taylor-series developments. Dissert. Abstr.

N73-16235 North Carolina State Univ., Raleigh.
AN ANALYTICAL INVESTIGATION OF AN OSCILLATING WEDGE IN A SUPERSONIC PERFECT GAS FLOW Ph.D. Thesis
Robert Merrill Bennett 1971 134 p
Avail: Univ. Microfilms Order No. 72-11985

Several aspects of the oscillating wedge are investigated to evaluate both the resulting trends for the wedge and methods of analyzing unsteady flows. The existing hypersonic small disturbance theory for the oscillating wedge is considered. Algebraic expressions are obtained for the low reduced frequency aerodynamic forces. Series expansions of the resulting forces in powers of 1/Mow reveal weak similarity parameters for the pitching rate derivatives that indicate that a simple scaling of flutter with ratio of specific heats is not apparent. The importance of the reflections of the waves generated by the surface from the shock is reemphasized. Aerodynamic damping terms are found to have significant influence on flutter even for large values of the mass ratio parameter. Dissert. Abstr.

N73-16236 Virginia Polytechnic Inst. and State Univ., Blacksburg.
LAMINAR OR TURBULENT BOUNDARY LAYER FLOWS OF PERFECT GASES OR REACTING GAS MIXTURES IN CHEMICAL EQUILIBRIUM Ph.D. Thesis
Euell Clay Anderson 1972 179 p
Avail: Univ. Microfilms Order No. 72-12501

A finite difference scheme is used to solve the laminar and turbulent boundary layer equations for perfect gases and reacting gas mixtures in chemical equilibrium. The formulation of the boundary layer equations neglects transverse curvature effects, and the equilibrium chemistry model assumes that the element composition across the boundary layer is constant. The numerical procedure is applied to both internal and external flow problems and the results are compared with experimental data and other numerical solutions. Solutions for laminar and turbulent flows of perfect gases and laminar flow of an equilibrium gas without mass transfer are in good agreement with experimental data and/or other numerical solutions. Dissert. Abstr.

N73-16237 Oklahoma Univ., Norman.
TURBULENT BOUNDARY LAYER GROWTH FAR DOWNSTREAM IN A SLOWLY EXPANDING HYPERSONIC NOZZLE Ph.D. Thesis
Lu-Chung Chang 1971 95 p
Avail: Univ. Microfilms Order No. 71-27602

A flow model for an axisymmetric hypersonic nozzle that allows for a smooth transition from turbulent to laminar-like flow is described. The pressure gradient is controlled by the nozzle shape. A criterion is established depending upon the shape parameter that predicts whether the flow remains fully developed turbulent or undergoes transition to a laminar-like form. The study concentrates the analysis on the behavior of the boundary-layer development far downstream in the nozzle flow. Heat transfer, boundary-layer displacement, and transverse curvature effects are taken into account. Dissert. Abstr.

N73-16238 Virginia Polytechnic Inst., Blacksburg.
SOLUTIONS FOR REACTING AND NONREACTING VISCOUS SHOCK LAYERS WITH MULTICOMPONENT DIFFUSION AND MASS INJECTION Ph.D. Thesis
James Norvel Moss 1972 222 p
Avail: Univ. Microfilms Order No. 72-12509

Numerical solutions of the viscous shock-layer equations where the chemistry is treated as being either frozen, equilibrium, or nonequilibrium are presented. The effects of the diffusion model, surface catalyticity, and mass injection on surface transport and flow parameters are considered. The equilibrium calculations for air species using multicomponent diffusion provide solutions previously unavailable. The same can also be said for the downstream nonequilibrium calculations where the diffusion is multicomponent. The viscous shock-layer equations are solved by using an implicit finite-difference scheme. The flow is treated as a mixture of inert and thermally perfect species. Also the flow is assumed to be in vibrational equilibrium. Dissert. Abstr.

N73-16239 Iowa State Univ. of Science and Technology, Ames.
BOUNDARY LAYER CONTRIBUTION TO THE MAGNUS EFFECT ON A SPINNING CYLINDER AT LOW ANGLES OF ATTACK Ph.D. Thesis
Howard Leon Power 1971 64 p
Avail: Univ. Microfilms Order No. 72-12585

The Magnus sideforce developed by a spinning cylinder at an angle of attack is calculated by considering contributions due to the boundary layer and its shed vorticity in the crossflow. A perturbation solution of the three-dimensional boundary layer is carried out for the case of small angle of attack and small nondimensional spin rate. The contributions to the Magnus sideforce due to the displacement thickness, radial pressure gradient correction and skin friction are then calculated. The crossflow is assumed to be similar to that of an impulsively rotated circular cylinder placed normal to the freestream. This assumption leads to axial circulation distribution due to shed vorticity that also contributes to the Magnus sideforce. The resulting sideforce coefficient exhibits a nonlinear variation with angle of attack at a constant nondimensional spin rate, contrary to the linear behavior predicted by previous theories.
Dissert. Abstr.

N73-16240 Purdue Univ., Lafayette, Ind.
THE ANALYSIS OF NONEQUILIBRIUM, CHEMICALLY REACTING, SUPERSONIC FLOW IN THREE DIMENSIONS Ph.D. Thesis
Michael Castle Cline 1971 166 p
Avail: Univ. Microfilms Order No. 72-8916

A second-order numerical method of characteristics was used to solve the equations of motion for three-dimensional, steady, supersonic, nonequilibrium, chemically reacting flow of a system of thermally perfect gases in an exhaust nozzle. A production type computer program which is capable of solving a wide variety of supersonic nozzle problems was developed for the CDC-6500 computer. Three bicharacteristic methods of characteristics were programmed for isentropic flow and compared, based on actual numerical calculations. Twenty-four ordinary differential equation schemes for solving the species continuity equation were also compared based on actual numerical calculations. A special implicit method was selected as the best technique. In addition to the nonequilibrium chemistry model, the program also considers frozen and equilibrium flows, and flows with constant specific heat ratios. The absolute accuracy and order of accuracy of the method was also given. Dissert. Abstr.

N73-16241 Purdue Univ., Lafayette, Ind.
NUMERICAL SOLUTION OF A VISCOUS COMPRESSIBLE SWIRLING FLOW THROUGH A DELAVAL NOZZLE Ph.D. Thesis
Robert Dohn Kissinger 1971 311 p
Avail: Univ. Microfilms Order No. 72-7979

An analytical investigation of a flow in a rotating choked convergent-divergent nozzle is performed to study the fluid mechanic effects of rotation within a nozzle. The fluid studied is assumed to be compressible, viscous and heat conducting. An order-of-magnitude analysis, making use of the slender nozzle approximation, is used to simplify the governing equations. The technique of quasilinearization is applied to linearize the equations, which are then written in finite-difference form using an implicit difference scheme. The resultant set of linear algebraic equations is solved simultaneously with a matrix inversion. Flow fields were calculated using selected nozzle and entrance flow configurations. Axial and tangential shear stresses and heat flux at the nozzle walls were evaluated numerically and compared with analytical predictions, with good agreement. The effects of nozzle length and energy transfer were also studied. Dissert. Abstr.

N73-16242 Louisiana State Univ., Baton Rouge.
ABLATION AND RADIATION COUPLED VISCOUS HYPERSONICS SHOCK LAYERS, VOLUMES 1 AND 2 Ph.D. Thesis
Carl David Engel 1971 660 p
Avail: Univ. Microfilms Order No. 72-17755

The aerothermal environment about a manned planetary return spacecraft was determined at typical atmospheric flight conditions. The thin shock layer equations were developed to theoretically evaluate this environment. The stagnation line equations for the shock layer were solved numerically. All known, significant shock-layer and ablator processes were included in this model. These processes include ablation and radiation coupling within the viscous shock layer, line and continuum radiation for both air and ablation species, local chemical equilibrium throughout the shock layer and quasi-steady ablator behavior. Coupled ablator-shock layer solutions were obtained for a phenolic nylon ablator. A two zone model was used to approximate the elemental species distribution within the shock layer and was found to be a valid approximation. The detailed discussion of the mathematical analysis used and the results obtained provide a sound basis for understanding many of the characteristic processes of hyperbolic entry heating. Dissert. Abstr.

N73-16243 Stanford Univ., Calif.
THE STRUCTURE AND STABILITY OF TURBULENT WALL LAYERS IN ROTATING CHANNEL FLOW Ph.D. Thesis
Dietrich Karl Lezius 1971 249 p
Avail: Univ. Microfilms Order No. 72-11601

An experimental and theoretical study of the stabilizing and destabilizing effects of the Coriolis body force upon turbulent wall layers in two-dimensional channel flow is reported. The Coriolis forces are created by steady system rotation about an axis perpendicular to the plane of mean flow. Flow visualization studies with the hydrogen bubble method were carried out for a Reynolds number range 3 x 1000 to 1.7 x 10,000 and values of the rotation parameter ranging from Ro = 0 to Ro = 0.57. The observed effects of rotation on the trailing and the leading sides of the channel have been documented. Stabilization of the local turbulent wall layers on the trailing side of the channel results in laminarization of the turbulence-producing layers up to approximately ten times the critical Reynolds number known for nonrotating channel flow. Dissert. Abstr.

N73-16244*# Tennessee Univ. Space Inst., Tullahoma.
A BOUNDARY LAYER APPROACH TO THE ANALYSIS OF ATMOSPHERIC MOTION OVER A SURFACE OBSTRUCTION Contract Report, 3 Jun. 1971 - 2 Sep. 1972
Walter Frost, J. R. Maus, and W. R. Simpson Washington NASA Jan. 1973 153 p refs
(Contract NAS8-27387)
(NASA-CR-2182; M109) Avail: NTIS HC $3.00 CSCL 20D

A boundary layer approach for the solution of the flow field induced over a two-dimensional surface obstruction, such as a building or other man-made structure, is proposed. Adopting a specific geometry in the form of a semi-elliptical cylinder, the characteristics of atmospheric shear flow over a rough terrain are coupled with the well-known boundary layer equations. Two approaches are presented to incorporate the pressure field and boundary conditions which exist within the large viscous region over the obstruction. The first considers a region in the immediate vicinity of the body in which the pressure distribution and outer boundary condition on the velocity are computed from potential theory for flow over the elliptical cylinder. The second approach considers a much larger region of influence, extending from the surface to the undisturbed flow at large heights above the obstruction. Methods which appear to provide an improved theoretical model of the flow over the ellipse, such as a technique for simulating the effect of the seperation regions upstream and downstream of the body, are also presented.
Author

N73-16245*# Case Western Reserve Univ., Cleveland, Ohio.
A GENERAL RELAXATION THEORY OF SIMPLE LIQUIDS
Mati Merilo and E. J. Morgan Washington NASA Jan. 1973 132 p refs
(Grants NGL-36-003-064; NSF GK-02866)
(NASA-CR-2141; FTAS/TR-72-73) Avail: NTIS HC $3.00 CSCL 20D

A relatively simple relaxation theory to account for the behavior of liquids under dynamic conditions was proposed. The general dynamical equations are similar in form to the phenomenological relaxation equations used in theories of viscoelasticity, however, they differ in that all the coefficients of the present equations are expressed in terms of thermodynamic and molecular quantities. The theory is based on the concept that flow in a liquid distorts both the radial and the velocity distribution functions, and that relaxation equations describing the return of these functions to their isotropic distributions, characterizing a stationary liquid, can be written. The theory was applied to the problems of steady and oscillatory shear flows and to the propagation of longitudinal waves. In all cases classical results are predicted for strain rates, and an expression for the viscosity of a liquid, simular to the Macedo-Litovitz equation, is obtained.
Author

N73-16246*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY STUDY OF A WALL STABILIZED CONSTRUCTED ARC
Randolph A. Graves and William L. Wells Washington Feb. 1973 36 p refs
(NASA-TM-X-2700; L-8631) Avail: NTIS HC $3.00 CSCL 20D

An iterative, implicit, finite-difference numerical technique is described which is suitable for obtaining solutions to the governing equations for a gas flowing in an axially symmetric constricted-arc heater. The method is shown to provide adequate solutions for three cases of simple pipe flows found in the literature, and for flow in a constricted-arc heater by direct comparison with experimental data. The comparison with arc-heater data includes static pressure, arc voltage, and wall heat flux, all as a function of axial location, and a radial temperature profile at one axial station. The arc-heater data were taken with air as the test gas at a heater inlet pressure approximately 0.40 atm and two flow rates of 2.2 and 4.8 g/sec. The arc currents investigated were between 377 and 584 amperes.
Author

N73-16247*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
DESIGN AND FLIGHT TESTING OF A NULLABLE COMPRESSOR FACE RAKE
Jon K. Holzman and Gordon A. Payne Washington Jan. 1973 17 p refs
(NASA-TN-D-7162; H-733) Avail: NTIS HC $3.00 CSCL 20D

A compressor face rake with an internal valve arrangement to permit nulling was designed, constructed, and tested in the laboratory and in flight at the NASA Flight Research Center. When actuated by the pilot in flight, the nullable rake allowed the transducer zero shifts to be determined and then subsequently removed during data reduction. Design details, the fabrication technique, the principle of operation, brief descriptions of associated digital zero-correction programs and the qualification tests, and test results are included. Sample flight data show that the zero shifts were large and unpredictable but could be measured in flight with the rake. The rake functioned reliably and as expected during 25 hours of operation under flight environmental conditions and temperatures from 230 K (-46 F) to greater than 430 K (314 F). The rake was nulled approximately 1000 times. The in-flight zero-shift measurement technique, as well as the rake design, was successful and should be useful in future applications, particularly where accurate measurements of both steady-state and dynamic pressures are required under adverse environmental conditions.
Author

N73-16248*# Inca Engineering Corp., San Gabriel, Calif.
AN APPARATUS FOR ESTABLISHING FLOW OF FLUID MASS HAVING A KNOWN VELOCITY Patent Application
Peter Price, Olgerts Veikins, Edward R. Bate, Jr., and Robert H. Jones, inventors (to NASA) Filed 14 Dec. 1972 23 p Sponsored by NASA
(NASA-Case-MFS-21424-1; US-Patent-Appl-SN-315048) Avail: NTIS HC $3.25 CSCL 20D

An apparatus for establishing a flow of fluid mass having a known velocity is described. It is characterized by an hermetically sealed chamber conforming to a closed-loop configuration that

includes a throat and axially displaceable pistons for sweeping through the throat a stream of gas. Within the throat is a cylindrical coring body concentrically related to the throat for receiving the core, and a chamber surrounding the cylindrical body for drawing off the boundary layer, whereby the velocity of the core is liberated from the effects of the velocity of the boundary layer. NASA

N73-16249*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
CALCULATION OF STABILITY DERIVATIVES FOR SLOWLY OSCILLATING BODIES OF REVOLUTION AT MACH 1.0
S. Y. Ruo and D. D. Liu Feb. 1971 52 p refs Prepared for Northrop Nortronics, Palos Verdes Peninsula, Calif.
(Contract NAS8-20082; NSL-PO-5-09287)
(NASA-CR-124033; HREC-0082-24) Avail: NTIS HC $4.75 CSCL 20D

A parabolic method for steady transonic flow is extended to bodies of revolution oscillating in a sonic flow field. A Laplace transform technique is employed to derive the dipole solution, and the Adams-Sears iterative technique is used in the stability derivative calculation. A computer program is developed to perform the stability derivative calculation for the slowly oscillating cone and parabolic ogive. Inputs for the program are body geometry thickness ratio, acceleration constant, and pitch axis location. Sample calculations were performed for the parabolic ogive and circular cone and results are compared with those obtained by using other techniques and the available experimental data for circular cones. Author

N73-16250# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON REGULAR REFLECTION OF A PLANE SHOCK IN WATER FROM A FREE SURFACE
V. A. Sharyi [1972] 7 p refs Transl. into ENGLISH from Vestn. Leningrad Univ. (Leningrad), no. 13, 1972 p 120-125
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The interaction of a plane shock wave with a free water surface is studied. Wave reflection flow is constructed with a class of nonstationary two dimensional waves for surface flow and extended to greater depths of sensor submersion by developing a pressure change diagram where the time interval corresponding to the passage of the pressure reduction waves through a fixed point growth as depth increases. Author

N73-16251*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTROL OF EXIT VELOCITY PROFILE OF AN ASYMMETRIC ANNULAR DIFFUSER USING WALL SUCTION
Albert J. Juhasz Washington Feb. 1973 23 p refs
(NASA-TM-X-2710; E-7169) Avail: NTIS HC $3.00 CSCL 20D

An asymmetric annular diffuser equipped with wall bleed (suction) capability was tested for controllability of exit velocity profile. The diffuser area ratio was 3.2, and the length to inlet height ratio was 1.6. Results show that the diffuser radial exit velocity profile could be controlled from a hub peaked to a tip peaked form by selective use of bleed on the outer wall or on both diffuser walls. Based on these results, application of the diffuser bleed technique to gas turbine combustors may be possible. Diffuser bleed could be used to tailor the airflow distribution for optimizing combustor performance at a variety of operating conditions. Author

N73-16252*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW GRAVITY REORIENTATION IN A SCALE-MODEL CENTAUR LIQUID-HYDROGEN TANK
Jack A. Salzman, William J. Masica, and Raymond F. Lacovic Washington Feb. 1973 33 p refs
(NASA-TN-D-7168; E-7098) Avail: NTIS HC $3.00 CSCL 20D

An experiment was conducted to investigate the process of liquid reorientation from one end of a scale-model Centaur liquid-hydrogen tank to the other end by means of low-level accelerations. Prior to reorientation, the liquid was stabilized at the top of the tank at a Bond number of 15. Tanks both with and without ring baffles and with tank radii of 5.5 and 7.0 centimeters were used in the study. Reorientation acceleration values were varied to obtain Bond numbers of 200 and 450. Liquid fill levels of 20 and 70 percent were used. From the data in this study, relations were developed to estimate reorientation event times in unbaffled tanks through the point of final liquid clearing from the top of the tank. The insertion of ring baffles drastically changed the reorientation flow profiles but resulted in only minor differences in the times of tank-top uncovering and liquid collection. Author

N73-16253*# New York Univ., N.Y.
TURBULENT BOUNDARY LAYER IN AN ADVERSE PRESSURE GRADIENT WITHOUT EFFECT OF WALL CURVATURE
Victor Zakkay and Wang Chi-Rong Nov. 1972 35 p refs
(Grant NGR-33-016-181)
(NASA-CR-112247) Avail: NTIS HC $3.75 CSCL 20D

The hypersonic compressible turbulent boundary layer in an adverse pressure gradient along a cylindrical axisymmetric body was studied. The tests were conducted in a Mach 6 contoured axisymmetric nozzle. An external compression cowl was used to produce the gradual adverse pressure gradient and a maximum pressure rise of 7 times the freestream static pressure was achieved in a test region of 23 cm. Boundary layer profiles of static pressure, total pressure, and total temperature, as well as wall transient heat transfer rates were measured. Comparisons of the velocity total temperature profiles to linear and quadratic relations were made. Measured heat transfer data were in good agreement with the prediction from the flat-plate reference enthalpy method. Integral parameters were also in good agreement with results of numerical solutions for compressible turbulent boundary layer equations. Author

N73-16254*# Scripta Technica, Inc., Washington, D.C.
CONDENSATION OF THE GAS PHASE OF A FAST-FLOWING ONE-COMPONENT LIQUID METAL DROPLET GAS MIXTURE
U. Michel NASA Feb. 1972 113 p refs Transl. into ENGLISH from the German report DLR-FB-72-01
(Contract NASw-2036)
(NASA-TT-F-14609; DLR-FB-72-01) Avail: NTIS HC $7.75 CSCL 20D

The condensation of the gas phase of a fast-flowing droplet-gas mixture of potassium with minimum losses in flow efficiency is studied. Two theoretical methods are examined in detail: (1) condensation on an injected, subcooled liquid hollow-core jet of the same material (injection condensation) and (2) condensation on a subcooled wall (wall condensation). The attainable mechanical and thermodynamic efficiencies are pointed out, together with an indication of how large such condensers become. Condensers of this type are needed to realize certain thermodynamic cycles with liquid metals as the working medium that are under consideration to drive MHD-generators for the production of electrical energy. Author

N73-16255*# National Bureau of Standards, Boulder, Colo.
CAVITATION IN LIQUID CRYOGENS. 2: HYDROFOIL
J. Hord Washington NASA Jan. 1973 162 p refs
(NASA Order C-39004-B)
(NASA-CR-2156) Avail: NTIS HC $3.00 CSCL 20D

Boundary layer principles, along with two-phase concepts, are used to improve existing correlative theory for developed cavity data. Details concerning cavity instrumentation, data analysis, correlative techniques, and experimental and theoretical aspects of a cavitating hydrofoil are given. Both desinent and thermodynamic data, using liquid hydrogen and liquid nitrogen, are reported. The thermodynamic data indicated that stable thermodynamic equilibrium exists throughout the vaporous cryogen cavities. The improved correlative formulas were used to evaluate these data. A new correlating parameter, based on consideration of mass limiting two-phase flow flux across the cavity interface, is proposed. This correlating parameter appears attractive for future correlative and predictive applications. Agreement between theory and experiment is discussed, and directions for future analysis are suggested. The front half of the cavities, developed on the hydrofoil, may be considered as parabolically shaped. Author

N73-16256# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
LAMINAR AND TURBULENT BOUNDARY LAYER [LAMINARE UND TURBULENTE GRENZSCHICHTEN]
1971 284 p refs In GERMAN; ENGLISH summaries Proc. of the DGLR Hydro-, Aero-, and Gasdyn. comm. meeting, Goettingen, West Ger., 7-8 Jun. 1971
(DLR-Mitt-71-13) Avail: NTIS HC $16.25; DFVLR, Porz: 38,70 DM

Results of recent boundary layer research are presented. Calculation methods for laminar and turbulent boundary layers in incompressible, supersonic, and hypersonic flows are discussed, as well as recent experimental results on turbulent boundary layers along walls and Goertler vortices near the stagnation point of a circular cylinder. For individual titles, see N73-16257 through N73-16267.

N73-16257 Technischen Universitaet, Munich (West Germany). Inst. fuer Stroemungsmechanik.
CALCULATION OF THE ENERGY LOSS DENSITY AND SHAPE PARAMETER OF LAMINAR BOUNDARY LAYERS BY MEANS OF SIMPLE QUADRATURE FORMULAS [DIE BERECHNUNG DER ENERGIEVERLUSTDICKE UND DES FORMPARAMETERS LAMINARER GRENZSCHICHTEN MITTELS EINFACHER QUADRATURFORMELN]
E. Truckenbrodt *In* DFVLR Laminar and Turbulent Boundary Layer 1971 p 5-27 refs In GERMAN; ENGLISH summary (For availability see N73-16256 07-12)

Quadrature formulas are derived for calculation of the energy loss density and the shape parameter of laminar boundary layers, in which only the distribution of the mean stream velocity appears. The case of an incompressible fluid is dealt with, and results are given for the case of a compressible fluid with an adiabatic wall. Author (ESRO)

N73-16258 Technische Hochschule, Aachen (West Germany). Inst. fuer Allgemeine Mechanik.
THEORETICAL INVESTIGATION OF WALL COOLING IN LAMINAR HYPERSONIC BOUNDARY LAYERS
D. H. Chung *In* DFVLR Laminar and Turbulent Boundary Layer 1971 p 28-50 refs In GERMAN; ENGLISH summary (For availability see N73-16256 07-12)

Wall cooling in laminar hypersonic boundary layers on flat plates was investigated theoretically for free stream Mach numbers 5.0, 10.24, and 15.0, and Reynolds numbers 2.2 x 10 to the 5th power, 4.06 x 10 to the 6th power, and 2.3 x 10 to the 7th power. The plate was cooled by ejecting the coolant tangentially to the surface. Air, helium, and argon were used as coolants, and cooling lengths were determined. Their dependence on the injected mass is demonstrated. In addition, the influence of changes in the initial conditions on the cooling length was investigated. The mixing of the hot external boundary layer and the injected coolant was studied by solving Prandtl's boundary layer equations with the Patankar-Spalding method.
Author (ESRO)

N73-16259 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
INVESTIGATIONS OF THE PROBLEM OF NORMAL PRESSURE GRADIENTS IN HYPERSONIC BOUNDARY LAYERS
E. H. Hirschel *In its* Laminar and Turbulent Boundary Layer 1971 p 51-73 refs In GERMAN; ENGLISH summary (For availability see N73-16256 07-12)

The conditions under which normal pressure gradients appear in boundary layer flows were investigated, using an order of magnitude analysis of the Navier-Stokes equations. The apparent sonic singularity which arises in a certain formulation of the governing equations and the instability of the solution in the subsonic layer were analyzed. The accuracy dependence of the solution on the step size in the normal direction was investigated by comparing numerical results. Author (ESRO)

N73-16260 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
ENERGY TRANSFER BY OXIDATION OF HYDROGEN IN LAMINAR HYPERSONIC BOUNDARY LAYERS [ENERGIEZUFUHR IN LAMINAREN HYPERSCHALLGRENZSCHICHTEN DURCH WASSERSTOFFVERBRENNUNG]
W. Kordulla and E. Krause *In its* Laminar and Turbulent Boundary Layer 1971 p 76-107 refs In GERMAN; ENGLISH summary (For availability see N73-16256 07-12)
(Contract DFG-KR-387/1)

The boundary layer equations for laminar, compressible two-dimensional air boundary layers with tangential injection of hydrogen are discussed. Numerical solutions were developed for the limiting cases of chemically frozen flow and flow in chemical equilibrium. The reactions for chemical equilibrium were approximated by the flame sheet model. In contrast to the binary gas model, each component of the gas mixture was considered separately in the transport coefficients and diffusional fluxes. Temperature gradients were assumed to be negligible in the diffusional fluxes, and only concentration gradients were taken into account. Author (ESRO)

N73-16261 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
MULTIPLACE METHOD FOR INTEGRATION OF THE BOUNDARY LAYER EQUATIONS [MEHRSTELLENVERFAHREN ZUR INTEGRATION DER GRENZSCHICHTGLEICHUNGEN]
E. Krause *In its* Laminar and Turbulent Boundary Layer 1971 p 109-140 refs In GERMAN; ENGLISH summary (For availability see N73-16256 07-12)

A finite difference technique for integrating the equations of motion for three dimensional turbulent boundary layers is presented. The truncation error is reduced from O(h2) to O(h4) by applying the multiplace method to three net points, thus improving the accuracy of the numerical solution. It is shown that the same accuracy can be achieved for variable step sizes without increasing the number of net points. The difference equations are developed, and the algorithm of the solution is discussed. The accuracy of the method is tested with a model equation. Author (ESRO)

N73-16262 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Rechenzentrum.
NUMERICAL INVESTIGATION OF THE PLATE BOUNDARY LAYER BY MEANS OF A RELATION FOR THE EDDY VISCOSITY [NUMERISCHE EXPERIMENTE MIT EINEM ANSATZ FUER DIE TURBULENTE ZAEHIGKEIT AM BEISPIEL DER PLATTENGRENZSCHICHT]
W. Schoenauer *In* DFVLR Laminar and Turbulent Boundary Layer 1971 p 141-159 refs In GERMAN; ENGLISH summary (For availability see N73-16256 07-12)

Equations for solutions of the turbulent boundary layer are derived from eddy viscosity. Free parameters are determined for the flat boundary layer by comparing solutions of the boundary layer equation with measurements. The solution describes the turbulent flat plate boundary layer, including the laminar sublayer. In the intermittent region at the outer edge of the boundary layer, the relation for the viscosity is improved. Author (ESRO)

N73-16263 Institut Franco-Allemand de Recherches, St. Louis (France).
HEAT TRANSFER MAXIMA MEASURED ON SPHERICALLY BLUNTED INCLINED CONES IN HOT HYPERSONIC FLOW [GEMESSEN E MAXIMA DES WAERMEUEBERGANGES AUF ANGESTELLTE KEGEL MIT KUGELNASE IN HEISSER HYPERSCHALLSTROEMUNG]
M. Fiechter *In* DFVLR Laminar and Turbulent Boundary Layer 1971 p 161-193 refs In GERMAN; ENGLISH summary (For availability see N73-16256 07-12)

Heat transfer to spherically blunted inclined cones with 12.5 deg half angle was measured in a nonreflected shock tunnel. At Mach numbers from 7.7 to 10.9, Reynolds numbers (cm) between 280 and 7100, and stagnation temperatures ranging from 3080 K to 4870 K, two heat transfer maxima appeared at the windward separation line. The first maximum was expected because of the recompression occurring downstream from the sphere-cone junction. Measurements of density profiles show that the variation of entropy at the edge of the boundary layer could

be the cause of the 2 maximum appearing at the cone.
Author (ESRO)

N73-16264 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Freiburg (West Germany). Inst. Fuer Angewandte Mathematik und Mechanik.
VISUALIZATION OF LONGITUDINAL VORTICES IN THE STAGNATION AREA OF A CIRCULAR CYLINDER IN TURBULENT FLOW
P. Colak-Antic *In its* Laminar and Turbulent Boundary Layer 1971 p 194-220 refs In GERMAN; ENGLISH summary (For availability see N73-16256 07-12)

The visualization of three-dimensional instability in the stagnation area of a circular cylinder with a splitting plate in turbulent flow is described. The experiments were performed in a small water towing basin at Reynolds numbers from 5000 to 49000. Longitudinal vortex disturbances occur, originating in the boundary layer in the stagnation area. They penetrate the stagnation surface and spread both ways in streamwise direction along the cylinder surface up to the boundary layer separation. The hydrogen bubble method and a suspension of aluminium particles were for the flow visualization.
Author (ESRO)

N73-16265 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Freiburg (West Germany). Inst. fuer Angewandte Mathematik und Mechanik.
HOT-WIRE MEASUREMENTS OF LONGITUDINAL INSTABILITY PHENOMENA IN THE STAGNATION AREA OF A CIRCULAR CYLINDER IN TURBULENT FLOW
H. Hassler *In its* Laminar and Turbulent Boundary Layer 1971 p 221-239 refs In GERMAN; ENGLISH summary (For availability see N73-16256 07-12)

In the front stagnation area of the circular cylinder, the velocity distribution exhibits a regular spanwise waviness. The wavelength of the spanwise velocity distribution depends mainly upon the Reynolds number and the turbulence of the oncoming flow. The results, together with visual observations, point to the occurrence of an array of longitudinal vortices in the stagnation area. Author (ESRO)

N73-16266 Max-Planck-Institut fuer Stromungsforschung, Gottingen (West Germany).
VISCOUS WALL FLOW IN TURBULENT BOUNDARY LAYER [DAS VERHALTEN DER VISKOSEN WANDSTROEMUNG IN TURBULENTEN GRENZSCHICHTEN]
H. Reichardt *In* DFVLR Laminar and Turbulent Boundary Layer 1971 p 240-260 refs In GERMAN; ENGLISH summary (For availability see N73-16256 07-12)

The general equations of motion were used to solve the differential heat conduction equation which describes the viscous shear stress fluctuations near a wall. The solution is proposed as an explanation for effects observed by hot film probes in the viscous sublayer of an oil channel flow. Author (ESRO)

N73-16267 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
TURBULENT LAYERS OF SEPARATION [TURBULENTE TRENNUNGSSCHICHTEN]
M. Strscheletzky *In its* Laminar and Turbulent Boundary Layer 1971 p 261-282 refs In GERMAN; ENGLISH summary (For availability see N73-16256 07-12)

An approximation method is described for calculating the turbulent boundary layers separating either two parallel linear flows or one linear flow from a stationary liquid. The method enables a simple predetermination of the size and the velocity field of the mixing and backflow zones. The method is based on the known similarity hypothesis of the turbulence theory. It is shown that the experimental correction of the calculated shear stresses depending on the turbulence parameter is only valid as a multiplicative constant for a full turbulent flow with similarly inelastic boundaries. A summary of the known measurements confirms the theoretical conclusions. Author (ESRO)

N73-16268# Sandia Labs., Albuquerque, N.Mex.
STABILITY OF LIQUID FILMS INTERACTING WITH SUPERSONIC STREAMS: THEORY AND EXPERIMENT
William S. Saric and Ali Hasan Nayfeh (Va. Polytechnic Inst.) [1972] 5 p refs Sponsored by AEC
(SC-DC-721225) Avail: NTIS

An investigation was made to experimentally and theoretically identify the regions of stable and unstable behavior of a liquid layer interacting with a high-pressure, supersonic airstream. Fifty-four experiments were conducted in a Mach 6 wind tunnel with a porous-tipped cone. Water and two different water-glycerin mixtures were used as test fluids. After a laminar or turbulent flow was established on the cone, the test liquid was ejected from the porous tip and subsequently forced back along the cone by the gas to form a liquid film. The wave motion on the gas/liquid interface was monitored electronically using two end-effect capacitance gauges and photographically using spark microphotographs and high-speed motion picture cameras. The output of the capacitance gauges were recorded on FM tape and were subsequently digitized and Fourier analyzed. These data provided the mean depth, the ratio of the RMS wave amplitude to the mean depth, and the Fourier spectrum of the wave motion. These results, in conjunction with the motion pictures, provided the wavelength and the wave-speed as functions of the liquid parameters and tunnel conditions. Author

N73-16269# Sandia Labs., Albuquerque, N.Mex.
EXPERIMENTAL INVESTIGATION OF THE LAMINAR BOUNDARY LAYER ON A SPINNING OGIVE-CYLINDER IN SUPERSONIC FLOW
William C. Ragsdale, Oscar L. George, Jr., Michael A. Brown, and Robert G. Ball [1972] 36 p refs Sponsored by AEC
(SC-DC-721173) Avail: NTIS

The supersonic laminar boundary layer on a body spinning at rates as high as 23,000 rpm was surveyed with Pitot probes. The test was conducted in a supersonic tunnel at Mach numbers of 3.02 and 4.10 and Reynolds numbers per foot of 1 million and 2 x 1 million. Pitot probing was accomplished at five longitudinal stations on the model, and at four peripheral locations at each station. Model angles of attack were 0 deg and 4 deg. Values of the model spin parameter were 0 and 0.2 radians.
Author

N73-16270# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
LINEAR VISCOUS STABILITY THEORY FOR STABLY STRATIFIED SHEAR FLOW: A REVIEW
Kenneth S. Gage 1972 32 p refs Presented at the 1972 IUCRM Colloq., San Diego, Calif., 5-16 Jun. 1972
(Contract AT(40-1)-4199)
(Conf-720632-1) Avail: NTIS

The linear viscous stability theory for stably stratified parallel shear flow is reviewed and some new results are presented. Attention is focused on recent work on unbounded flows with emphasis placed on results which demonstrate apparent destabilizing effects of diffusivity which lie beyond the scope of inviscid theory. In particular it is shown that self-excited disturbances may exist with phase speeds lying outside the range of basic flow speed and that with strong thermal diffusivity instability may occur even though the local Richardson number exceed 0.25 throughout the flow. Author

N73-16271# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Kernverfahrenstechnik.
DETERMINATION OF DISSIPATIVE LOSSES IN THE SEPARATION NOZZLE FLOW WITH PITOT-TUBES Ph.D. Thesis - Tech. Hochschule, Karlsruhe
P. Bley and W. Ehrfeld Mar. 1971 46 p refs In GERMAN; ENGLISH summary
(KFK-1562) Avail: AEC Depository Libraries

The dissipative losses in the separation nozzle flow were investigated by measuring the impact pressure profiles and the concentration profiles at the separation nozzle exit. Measurements with H_2/C_7F_{14}-gas mixture show that under flow conditions normally used in uranium isotope separation, 60% of the total losses of the process occur in the nozzle system proper. The dissipative losses in the nozzle are mainly caused by friction, whereas the strong demixing in the flow field contributes less to dissipation. By the strong spatial separation between the light carrier gas and the heavy component of the mixture most of the kinetic energy of the flow is transferred into the heavy fraction. Nevertheless, an isentropic pressure recovery of the light

fraction, which contains about 75% of the total flow, would still reduce by 25% the specific energy costs of the separation nozzle process. An efficient pressure recovery should be possible with a nozzle arrangement which combines the small streams from many nozzles to a uniform flow. Author (NSA)

N73-16272# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.

SOLUTION OF THE BOUNDARY LAYER EQUATIONS FOR CHEMICALLY REACTING GASES BY MEANS OF A HERMITIAN FINITE DIFFERENCE METHOD [LOESUNG DER GRENZSCHICHTGLEICHUNGEN FUER CHEMISCH REAGIERENDE GASE MIT EINEM MEHRSTEL-LENVERFAHREN]

Norbert Peters Jan. 1972 157 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-58) Avail: NTIS HC $10.00; DFVLR, Porz, West Ger. 40,50 DM

A highly accurate finite difference method was developed for solving the boundary layer equations of the laminar chemically reacting flat plate flow of a binary gas mixture. The derivatives in flow direction were replaced by second order finite difference relations. The resulting ordinary differential equations were solved with a fourth order Hermitian finite difference scheme. The stability of the finite difference formulation and the convergence of the iteration procedure are discussed. Numerical results are presented for various flow parameters including a nonequilibrium flow along a plate with discontinuously changing catalytic efficiency. The listing of the FORTRAN program is included. Author (ESRO)

N73-16273# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

THE ASSERTION THAT ALL RECTANGLES ARE SQUARE OR A CRITICAL REVIEW OF SOME METHODS OF PROOF GENERALLY ACCEPTED IN THE KINETIC THEORY OF GASES AND PLASMAS

Erling Dahlberg Nov. 1972 38 p refs

(TRITA-EPP-72-25) Avail: NTIS HC $4.00

The unspecified relation d(c1') d(c2') = d(c1) d(c2), between initial (c1, c2) and final (c1', c2') velocities in a binary collision between particles 1 and 2, as used in the derivation of Boltzmann's collision term, is shown to be false and equivalent, for example, to the statement that all rectangles are square. The introduction of this false assertion forces its users to imply or state a second false assertion to reconnect the chain of argument. Four derivations are sketched which, although not necessarily longer than those commonly given, are principally comprehensible. Some mal-practices wide-spread in texts on gas kinetics are discussed. Author (ESRO)

N73-16274# ARO, Inc., Arnold Air Force Station, Tenn.

SIMULATION OF A HIGH DISC LOADING FREE PROPELLER IN A CROSS FLOW BY THE VORTEX-LATTICE METHOD Final Report, 10 Nov. 1969 - 30 Jun. 1971

R. L. Parker, Jr. and F. L. Heltsley AEDC Nov. 1972 102 p refs

(Contract F40600-73-C-0004; AF Proj. 69BT; ARO Proj. BD5026)

(AD-751463; ARO-OMD-TR-72-98; AEDC-TR-72-139) Avail: NTIS CSCL 01/3

A study was conducted to develop an analytical model for the investigation of flow fields about intermediate disc loading lift devices for VTOL applications. Classical vortex-lattice theory was used in conjunction with experimental data for representing a free propeller in a crossflow. The jet phenomena to be simulated by the method are discussed. A number of previous attempts at vortex-lattice modeling are presented. Analytical stream lines and field vectors are compared with available experimental data. The results are evaluated and recommendations are made for further model development. Author (GRA)

N73-16275# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.

A PROVISIONAL ANALYSIS OF TWO DIMENSIONAL

(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. SQUID)

(AD-751541; SQUID-TR-UCSD-1-PU) Avail: NTIS CSCL 20/4

A predictive method for the titled flows based on the Prandtl energy method is developed and assessed by comparing prediction with experimental results. For constant density flows both gross properties such as spreading rate and maximum turbulent kinetic energy and detailed properties such as mean shear stress distribution are shown to be well predicted. For variable density flows considerable attention is devoted to the inclusion in the analysis of the added effect of pressure fluctuations and of the variation in the several extant empirical parameters on the turbulent kinetic energy. Author (GRA)

N73-16276# California Univ., Berkeley. Fluid Mechanics Div.

NUMERICAL STUDY OF SLIGHTLY VISCOUS FLOW

Alexandre Joel Chorin Sep. 1972 29 p refs

(Contract N00014-69-A-0200-1052)

(AD-751628; FM-72-4) Avail: NTIS CSCL 20/4

A numerical method for solving the time-dependent Navier-Stokes equations in two space dimensions at high Reynolds number is presented. The crux of the method lies in the numerical simulation of the process of vorticity generation and dispersal, using computer generated pseudo-random numbers. An application to flow past a circular cylinder is presented. Author (GRA)

N73-16277# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.

A STUDY OF FLOW FIELDS IN BISTABLE FLUID AMPLIFIERS, PART 2: ANALYTICAL INVESTIGATION

W. Barry Wagner and Jerzy A. Owczarek Jun. 1972 267 p refs

(Contract N00014-69-A-0417; Proj. Themis)

(AD-751606; Themis-LU-TR-10-Pt-2) Avail: NTIS CSCL 13/7

An analysis was conducted to predict the extent of the total pressure loss regions existing in the corner between the sidewall and horizontal nozzle walls at the exits of planar nozzles having convex contour curvature. The nozzle contours and experimental corner total pressure profiles are described in part I. An analytical model employing a deformable control volume convected by the streamwise flow in the nozzle was formulated. Sidewall boundary layer cross-flow which accumulates in the corner to form the total pressure loss region was assumed to enter the control volume. A large cross-flow solution of the incompressible, three-dimensional, laminar boundary layer equations in bi-polar streamline coordinates was used to predict the sidewall secondary flow as a function of Reynolds number and nozzle shape. Author (GRA)

N73-16278# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.

DESIGN AND ANALYSIS OF A PROPORTIONAL FLUID AMPLIFIER

Kenneth C. Heck and James P. Ries Jul. 1972 84 p refs

(Contract N00014-69-A-0417)

(AD-751457; Themis-LU-TR-11) Avail: NTIS CSCL 13/7

The study is part of a continuing research effort to develop a model suitable for predicting the dynamic performance of the jet interaction type, proportional fluid amplifier. The model presented in this study takes into account the dynamics of the connecting air lines and load as well as the physical phenomena occurring within the amplifier. The resulting equations are developed in an analog format suitable for parametric study and nonlinear simulation to predict static and dynamic performance for this type of fluid amplifier. A large scale plexiglass model was designed to operate on air at room temperature. Results of this experimental study are presented for the steady state performance of the amplifier. Author (GRA)

N73-16279# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

AN ANALYTICAL SOLUTION OF THE COMPRESSIBLE LAMINAR MOMENTUM AND THERMAL BOUNDARY

(Contract DAHC04-69-C-0016; Proj. Themis)
(AD-751804; Rept-72-29; AROD-T-4-47-E) Avail: NTIS CSCL 20/4

The study describes an analytical solution of the nonsimilar laminar boundary layer with pressure gradient, variable wall temperature and continuous injection. The method consists of transforming the partial differential equations for momentum and enthalpy and then solving the transformed equations by assuming polynomial stream function and enthalpy profiles. Solutions obtained show very good agreement with exact numerical results. The solutions are obtained for flows over wedges as well as at the two-dimensional stagnation point and over curved surfaces of a two-dimensional body in crossflow. The results of the study show that the boundary layer is very strongly effected by the injection mass flow rate. Author (GRA)

N73-16280# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL AEROMECHANICS (CHAPTERS 6, 7, 8, AND 9,)
S. M. Gorlin 30 Jun. 1972 351 p refs Transl. into ENGLISH from the book "Eksperim Aeromekhan" Moscow, 1970 p 147-403
(AD-751464; FTD-MT-24-1902-71) Avail: NTIS CSCL 20/4

The book deals with physical principles of experimental aeromechanics and methods for aeromechanical tests in various conditions. Given is the description of various wind tunnels and installations for experimental investigations at subsonic, supersonic and hypersonic velocities. The book was written for college students of aerohydromechanics and gas dynamics. It can be useful also to employees of design offices and scientific organizations, as well as persons engaged in construction of various aeromechanical installations and their equipment.
Author (GRA)

N73-16281# Naval Ship Research and Development Center, Bethesda, Md.
DRAG REDUCTION AND SHEAR DEGRADATION OF DILUTE POLYMER SOLUTIONS AS MEASURED BY A ROTATING DISK
T. T. Huang and N. Santelli Sep. 1972 31 p refs
(ZR0230101)
(AD-751552; NSRDC-3678) Avail: NTIS CSCL 20/4

A saturated drag-reduction line for dilute polymer solutions is derived for a rotating disk from new velocity-similarity laws. Drag reduction measured by a rotating disk is found to have three domains--oversaturated, optimal and undersaturated. At a given boundary-layer thickness and wall-shear stress, the drag-reduction increases with increasing concentration in the undersaturated domain, and the drag reduction does not increase with increasing concentration in the oversaturated domain. The boundary between the two domains is the optimal drag reduction, which is determined by the type of polymer and its concentration and a Reynolds number based on shear velocity and disk radius or boundary-layer thickness. Author (GRA)

N73-16282# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
A STUDY OF FLOW FIELDS IN BISTABLE FLUID AMPLIFIERS. PART 1: EXPERIMENTAL INVESTIGATION
W. Barry Wagner and Jerzy A. Owczarek Jun. 1972 220 p refs
(Contract N00014-69-A-0417)
(AD-751627; THEMIS-LU-TR-9-Pt-1) Avail: NTIS CSCL 13/7

The three-dimensional nature of the flow fields in planar nozzles and wall jets found in bistable fluid amplifiers was investigated. Detailed total pressure measurements were made at the exit plane of nozzles having convex wall curvature for cases with flow supplied perpendicular and parallel to the nozzle exit flow direction. Significant low total pressure regions in the corners of the nozzles caused by sidewall boundary layer cross-flow in the vicinity of the convex nozzle walls were found in both cases. Midplane total pressure loss regions were found in the parallel supply flow case only. They were produced by secondary flows generated at the transition from round to rectangular flow area at the nozzle inlet. Author (GRA)

N73-16283# Douglas Aircraft Co., Inc., Long Beach, Calif.
A NEW FAMILY OF AIRFOILS BASED ON THE JET-FLAP PRINCIPLE Technical Report, Apr. 1971 - Apr. 1972
Andrew B. Bauer Sep. 1972 63 p refs
(Contract N00014-71-C-0250; NR Proj. 215-189)
(AD-751075; MDC-J5713) Avail: NTIS CSCL 20/4

A new family of airfoils is based largely on the utilization of the jet flap principle and termed power profiles. Several unique features associated with this new concept, and the applicability of existing experimental data and theoretical methods to its evaluation, design and development are described. This technology is used to develop a configuration suitable for wind tunnel testing, and the report concludes with a discussion of some outstanding aerodynamic problems for which analytical and experimental research is required. GRA

N73-16284# Naval Postgraduate School, Monterey, Calif.
TURBULENCE STUDIES OF THE FLOW OF DILUTE POLYMER SOLUTION ABOUT CIRCULAR CYLINDERS M.S. Thesis
Joel Rea Fitts Jun. 1972 82 p refs
(AD-751640) Avail: NTIS CSCL 20/4

The study was a continuation of previous investigations of the flow of dilute (25 WPPM) polymer (Polyox WSR-301) solutions about bluff bodies in the drag transition flow regime. Detailed measurements of turbulence intensity, and turbulence microscale were taken in the near wake region of a circular cylinder for several degradation states of polymer flow. Additionally, the effects of polymer degradation upon hot-film anemometer operations were determined. The results of this study substantiated the determinations on turbulence indices in polymer flows which were previously reported. Author (GRA)

N73-16285# Harry Diamond Labs., Washington, D.C.
FLUERICS. 33: DESIGN AND STAGING OF LAMINAR PROPORTIONAL AMPLIFIERS
Francis M. Manion and George Mon Sep. 1972 45 p
(DA Proj. 1T0-61102-A-33B; HDL Proj. 302231)
(AD-751182; HDL-TR-1608) Avail: NTIS CSCL 13/7

The report discusses the design and staging of a laminar flueric proportional amplifier with a pressure gain greater than 15, a dynamic range of over 1000, and a bandwidth ranging from 100 to 1000 Hz depending on the supply pressure. By scaling with Reynolds number based on channel depth, several of these elements have been connected in series to form a three-stage, open-loop gain block with a pressure gain greater than 1000, a dynamic range of over 400, and a bandwidth greater than 100 Hz. The output of the amplifier itself and of the gain block has a flat saturation characteristic. Author (GRA)

N73-16286# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BENDING AND DEVELOPMENT OF THREE-DIMENSIONAL TURBULENT JETS IN A CROSSWIND
Hiroshi Endo and Masayoshi Nakamura 31 Aug. 1972 67 p refs Transl. into ENGLISH from Koku Gijutsu Kenkyujo Hokoku (Japan), no. 11, Nov. 1970
(AF Proj. 1366)
(AD-751093; FTD-HC-23-1486-71) Avail: NTIS CSCL 20/4

A semiempirical theory on the bending and development of a round turbulent jet in a subsonic crosswind is presented. A theoretical model of dynamical interaction between the jet and external flow has been formulated by combining an entrainment model and a vortex sheet model, taking into account the inward flow of air outside into the jet induced by a pair of concentrated vortices on the rear side of the jet. The mass inflow rate is related to the moment of the vortex-doublet. Author (GRA)

N73-16287# European Research Office, London (England).
ATTENDANCE AT THE 5TH CRANFIELD, FLUIDICS CONFERENCE Trip Report
R. L. Scharpe Oct. 1972 17 p refs Conf. held at Uppsala, 13-16 Jun. 1972
(AD-751186; ERO-13-72) Avail: NTIS CSCL 13/7

The report describes the 5th Cranfield Fluidics Conference held in Uppsala, Sweden, during 13-16 June 1972. The conference was sponsored and organized by the British Hydronautic Research Association (BHRA), Cranfield, England, and the Fluidistorkommit-

ten of the Swedish Board for Technical Development. Approximately 50 papers were presented of the 190 papers originally submitted. Nearly 200 representatives from 19 countries attended the conference. Author (GRA)

N73-16952 National Museum of Natural History, Paris (France).
SELF OSCILLATIONS IN A VARIABLE DEPTH ROTATING BASIN. SECOND CLASS MODES [OSCILLATIONS PROPRES DANS UN BASSIN TOURNANT DE PROFONDEUR VARIABLE. MODES DE SECONDE CLASSE]
B. Saint-Guily *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 15-25 refs In FRENCH (For availability see N73-16950 07-34)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-16288 Illinois Univ., Urbana.
INVESTIGATION OF THE PHYSICS OF DYNAMICAL PROCESSES IN THE TOPSIDE F-REGION Ph.D. Thesis
Lynn Allen Carpenter 1971 226 p
Avail: Univ. Microfilms Order No. 72-12115

The technique for determining plasma drifts is developed. Observations at altitudes between 450 and 750 km are used to construct a description of the behavior of the ionosphere. Seven 24-hr operations in 1968 are examined, and grouped as late summer, equinox, winter, and disturbed conditions. The diurnal behavior of the vertical velocity is studied as well as the short-period fluctuations in this vertical velocity that are superposed on the diurnal behavior. These fluctuations occur during about 30% of the observations and are attributed to traveling ionospheric disturbances. Vertical transport processes are examined for midlatitude and compared with the measured vertical velocity. The diurnal variation and altitude variation of these processes are used in assessing their relative effect during different times of day. Dissert. Abstr.

N73-16289 Kansas Univ., Lawrence.
REMOTE SENSING OF OCEAN WINDS USING A RADAR SCATTEROMETER Ph.D. Thesis
Gerald Arthur Bradley 1971 210 p
Avail: Univ. Microfilms Order No. 72-11732

The purpose is to show the relationship between radar scattering coefficient and ocean wind speed and direction using measurement data taken by a radar scatterometer operating at a frequency of 13.3 GHz with vertical polarization. It is shown that past experimental and theoretical results have indicated a possible dependency of the radar scattering coefficient on the ocean wind speed and direction. It is shown that problems encountered early in the research program with the radar equipment required a system analysis study to be performed in order to assure valid data measurements. The results are presented and are used to interpret and adjust the measured data in order to investigate the relationship between radar scattering coefficient and ocean wind information. Dissert. Abstr.

N73-16290 Dartmouth Coll., Hanover, N.H.
TRAVELLING IONOSPHERIC DISTURBANCES Ph.D. Thesis
Carlos Hugo Janier Calderon Chamochumbi 1972 175 p
Avail: NTIS Avail: Univ. Microfilms Order No. 72-12627

A general study of traveling ionospheric disturbances (T.I.D.'s) has been undertaken. In the theoretical aspect, the gravity wave resonant mode has been studied and the concept of an ionospheric predictive function has been introduced. In the experimental aspect, the digital data processing portion of the Dartmouth ionosonde network has been brought into operation and seven T.I.D. events have been analyzed with it. The data have been interpreted in light of Hooke's theory and substantial agreement has been found. Further investigation, both theoretical and experimental, of the gravity wave resonance mode, and the adoption of the iso-height contour presentation of the data rather than the iso-ionic fashion which is conventional in the T.I.D. field, are recommended. Still greater automation in the Dartmouth ionospheric data processing system and the operation of a fourth semi-mobile station, are also recommended. Dissert. Abstr.

N73-16291 Howard Univ., Washington, D.C.
A SEARCH FOR LOW FREQUENCY RADIO CONTINUUM ARISING IN THE INNER MAGNETOSPHERE Ph.D. Thesis
Richard Lomie Johnson 1971 228 p
Avail: Univ. Microfilms Order No. 72-14039

There are two potential sources of radio emission which could produce a continuum. Radio emission from both trapped electrons within the inner Van Allen belt as well as from untrapped electrons which flow into the auroral regions is considered. The first observations showed the existence of both sporatic and continuum emission arising from the lower magnetosphere. The radio emission is studied arising from the inner Van Allen belt. Dissert. Abstr.

N73-16292 Stanford Univ., Calif.
A LINE OF SIGHT MICROWAVE PROPAGATION EXPERIMENT FOR RESOLVING THE MOTIONS AND TURBULENT STRUCTURE OF THE ATMOSPHERE Ph.D. Thesis
Jeffrey Claude Harp 1971 150 p
Avail: Univ. Microfilms Order No. 72-11567

This work is concerned with the problem of determining something of the nature of the turbulent atmosphere by studying the perturbations it induces upon a radio wave propagated through it. An experimental system is described which operates at a frequency of 34.89 GHz over a 28 km path. The receiver consists of an array of eight horizontally spaced antennas, and the transmitter consists of two horizontally spaced antennas which are full-shared by the receiving array. The data consists of amplitude and relative phase measured at each of the eight receiving points for both transmitters. The transmitters are alternated quite rapidly (relative to the characteristic time of the atmospherically induced fluctuations) so that from the data a variety of propagation geometries may be studied - one-transmitter-two-receiver, two-transmitter-one-receiver, and two-transmitter-two-receiver. The analyses consist primarily of calculating covariances between data channels (with and without time lags) for the various propagation geometries available. Dissert. Abstr.

N73-16293 Pittsburgh Univ., Pa.
OPTICAL DETECTION OF RADIO FREQUENCY HEATING OF ELECTRONS IN THE F-REGION Ph.D. Thesis
Dwight Passmore Sipler 1971 94 p
Avail: Univ. Microfilms Order No. 72-17098

Electron heating in the F region by a high power beam of radio frequency energy was detected by the intensity of the 6300 A line of the atomic oxygen nightglow. Collisional absorption of RF energy propagated in the extraordinary mode produces a small transient suppression of the intensity of the 6300 A line as a result of the decrease in the dissociative recombination production of O(1D) atoms with increasing electron temperature. A plasma instability triggered by the high intensity rf fields propagated in the ordinary mode was observed to cause large increases in the 6300 A line intensity by direct electron impact excitation of the 1D state of atomic oxygen. Measurements of the time constants of these intensity changes have enabled a (an in-situ) determination of the quenching coefficient for the O(1D) state assuming the quenching is due to N2. A value Kg = (5 plus or minus 2) x 10 to the minus 11th power cu cm/sec was obtained. Dissert. Abstr.

N73-16294 Stanford Univ., Calif.
AN OCCULTATION SATELLITE SYSTEM FOR DETERMINING PRESSURE LEVELS IN THE ATMOSPHERE Ph.D. Thesis
Steven George Ungar 1972 194 p
Avail: Univ. Microfilms Order No. 72-16809

A two satellite microwave occultation system is described that will fix as an absolute function of altitude the pressure-temperature profile generated by a passive infrared sounder. This method would be successful in determining the altitude of the 300 mb pressure level to within 24 m rms, assuming the temperature errors produced by the IR sensor are not greater than 2 deg K rms. Error caused by water vapor in the radio path can be corrected by climatological adjustments (by use of

mean water vapor profiles) if accurate water vapor sensors are not available. A ground test of the proposed system is described. A microwave signal propagating between two mountain tops was found to be subject to periods of intense fading. Computer analysis of the raypath between the transmitting and receiving stations indicates that multipath and defocusing were responsible for this fading. Because these phenomena are associated with lower altitudes it is unlikely that an operational pressure-reference-level system will be subject to the deep fades observed in the ground test. Dissert. Abstr.

N73-16295 California Univ., Los Angeles.
DEPENDENCE OF THE POLARIZATION FEATURES OF THE DIFFUSE RADIATION FIELD OF THE EARTH'S ATMOSPHERE ON THE LOCATION OF A CONCENTRATED AEROSOL LAYER Ph.D. Thesis
Tsutomu Takashima 1971 93 p
Avail: Univ. Microfilms Order No. 72-9240

To estimate the feasibility of indirect optical methods to model the aerosol structure of the real atmosphere, a concentrated aerosol layer is placed at intermediate levels of the pure Rayleigh atmosphere. In such a model atmosphere, the scattering parameters of the diffusely transmitted and reflected radiation, namely the degree of maximum polarization, the dispersion of polarization, and the position of three neutral points are computed in terms of the height. The absolute value and the wavelength dependence of the measured maximum polarization can be explained by this model atmosphere. It is also observed that the degree of maximum polarization exhibits a sensitive dependence on the location of the concentrated aerosol layer. This dependence is more pronounced in the case of diffusely reflected radiation than skylight radiation. Dissert. Abstr.

N73-16296 Stanford Univ., Calif.
THE COUPLING BETWEEN THE IONOSPHERE AND THE PROTONOSPHERE AND ITS IMPLICATIONS ON THE LONG-TERM VARIATIONS OF IONOSPHERIC ELECTRON CONTENTS Ph.D. Thesis
Helio Waldman 1972 185 p
Avail: Univ. Microfilms Order No. 72-16812

Recent experimental determinations of the flux of ionization between the ionosphere and the protonosphere have indicated that, during the day, the plasma will often flow upwards at a rate that by far exceeds the previously calculated theoretical limit of that flux. The theory of the coupling between the two layers is reexamined in the flight of the new evidence, and the discrepancy mentioned above is shown to be probably due to a previous underestimation of the neutral hydrogen concentrations in the thermosphere. The present work also includes a review of the basic processes occurring in the ionosphere, with emphasis on the concepts of limiting velocity and limiting flux. In addition, an approach to the problem of numerical simulation of the ionosphere is presented and discussed. Dissert. Abstr.

N73-16297 Wisconsin Univ., Madison.
A NUMERICAL STUDY OF ADVECTIVE EFFECTS OF BOUNDARY LAYER FLOW AT LOW LATITUDES Ph.D. Thesis
Larry Joe Mahrt 1972 244 p
Avail: Univ. Microfilms Order No. 72-13982

Certain simplified steady boundary layer flows are examined at low latitudes where the Coriolis parameter is small and momentum advections may be large. These flows are studied both analytically and with a multilevel two dimensional numerical model. This model is designed to include a one layer representation of the free atmosphere where pressure adjustments are allowed. Analyses of several finite difference schemes in terms of numerical stability and truncation errors for the equations of motion are conducted to aid in the construction of the model. Two main flow types are found by specifying the pressure of heating field: drift ordinary boundary layer flow where momentum advections are large, and quasi-geostrophic Ekman flow where advections are small. Dissert. Abstr.

N73-16298 Kansas Univ., Lawrence.
THE DISCRIMINATION OF TROPICAL LAND USE IN PUERTO RICO: AN ANALYSIS USING MULTISPECTRAL IMAGERY Ph.D. Thesis
Roland Deloy Mower 1971 233 p
Avail: Univ. Microfilms Order No. 72-1181

This study evaluated various types of multispectral remote sensor imagery to assess their usefulness for discriminating and mapping land use categories found in a tropical environment. Several related problems were analyzed: (1) Determine if existing land use categories were applicable to remote sensor imagery. (2) Determine if unique or redundant data were acquired by the various channels of the remote sensor system. (3) Determine if land use categories could be correctly discriminated at the 90 percent level. (4)Determine if additional data improved discrimination decisions. (5) Determine if certain channels or combinations were better land use discriminators than others. (6) Determine if automated imagery interpretation was more or less reliable than human interpretation. Ten gross land use categories were identified in Puerto Rico, which was selected as the test region. Overall, the multiband channels provided the best discrimination of land use categories in the Puerto Rican test region. Dissert. Abstr.

N73-16299*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF TIME LAPSE DATA PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS Progress Report, 7 Nov. 1972 - 6 Jan. 1973
Sidney M. Serebreny, Principal Investigator 6 Jan. 1973 7 p
Original contains imagery. Original photography may be purchased from EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21841)
(E73-10035; NASA-CR-129995) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-16300*# Wyoming Univ., Laramie. Dept. of Geology.
ANALYSIS OF ERTS-1 IMAGERY OF WYOMING AND ITS APPLICATION TO EVALUATION OF WYOMING'S NATURAL RESOURCES Progress Report, Jul. - Dec. 1972
Ronald W. Marrs 20 Jan. 1973 23 p refs
(Contract NAS5-21799)
(E73-10037; NASA-CR-129997; ERTS-1-II-72A) Avail: NTIS HC $3.25 CSCL 08F

The author has identified the following significant results. Significant results of the Wyoming investigation during the first six months include: (1) successful segregation of Precambrian metasedimentary/metavolcanic rocks from igneous rocks; (2) discovery of iron formation within the metasedimentary sequence; (3) mapping of previously unreported tectonic elements of major significance; (4) successful mapping of large scale fractures of the Wind River Mountains; (5) sucessful distinction of some metamorphic, igneous, and sedimentary lithologies by color-additive viewing of ERTS images; (6) mapping and interpretation of glacial features in western Wyoming; and (7) development of techniques for mapping small urban areas.

N73-16301*# Tri-State Regional Planning Commission, New York.
INVESTIGATION OF SATELLITE IMAGERY FOR REGIONAL PLANNING Progress Report
William Harting, Principal Investigator 29 Dec. 1972 1 p
(Contract NAS5-21738)
(E73-10038; NASA-CR-130285; PR-1) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-16302*# Purdue Univ., Lafayette, Ind.
IDENTIFICATION OF CROP SPECIES BY COMPUTER PROCESSING OF ERTS-1 MSS DATA
31 Jan. 1973 2 p
(E73-10039; NASA-CR-130299) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-16303*# Tennessee Univ., Knoxville. Dept. of Geography.
GEOGRAPHIC APPLICATIONS OF ERTS-1 IMAGERY TO RURAL LANDSCAPE CHANGE IN EASTERN TENNESSEE
John B. Rehder, Principal Investigator and James R. OMalley 30 Jan. 1973 23 p Proposed for presentation at 2d Ann. Remote Sensing of Earth Resources Conf., Tullahoma, Tenn., 26-27 Mar. 1973 Submitted for publication Original contains

imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 (Contract NAS5-21726)
(E73-10040; NASA-CR-130319) Avail: NTIS HC $3.25 CSCL 08F

There are no author-identified significant results in this report. A multistage sampling experiment was conducted using low (10,000') and high (60,000') altitude aircraft imagery in comparison with orbital (560 miles) ERTS imagery. Although the aircraft data provide detailed landscape observations similar to ground truth data, they cover relatively small areas per image frame for irregular static slices of time. By comparison, ERTS provides repetitive observations in a regional perspective for broad areal coverage. Microdensitometric and computer techniques are being used to analyze the ERTS imagery for gray tone signatures, comparisons, and ultimately for landscape change detection.

N73-16304*# Colorado School of Mines, Golden.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO Progress Report, 30 Nov. 1972 - 31 Jan. 1973
Daniel H. Knepper, Jr., Principal investigator and Stephen M. Nicolais 29 Jan. 1973 3 p
(Contract NAS5-21778)
(E73-10041; NASA-CR-130320) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-16305*# Texas Technological Univ., Lubbock. Dept. of Geosciences.
DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS Progress Report, 30 Nov. 1972 - 30 Jan. 1973
C. C. Reeves, Jr., Principal Investigator 30 Jan. 1973 3 p
(Contract NAS5-21720)
(E73-10042; NASA-CR-130321) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-16306*# Oceanographic Services, Inc., Santa Barbara, Calif.
ACQUISITION AND ANALYSIS OF COASTAL GROUND TRUTH DATA FOR CORRELATION WITH ERTS-A IMAGERY Bimonthly Progress Report, 2 Dec. 1972 - 2 Feb. 1973
Richard C. Miller, Principal Investigator 1 Feb. 1973 3 p
(Contract NAS5-21877)
(E73-10043; NASA-CR-130322; BMPR-2) Avail: NTIS HC $3.00 CSCL 08C

The author has identified the following significant results. Examination of the digital image of Monterey Bay, California area indicates more resolution in all MSS bands than found in the film imagery. This inability to delineate subtle density variations may be similar to those difficulties encountered by some investigators at the light end of the spectrum. Because the digital image is large and only certain areas of the total image are enhanced at one time, the digital technique of presenting MSS imagery is complimentary with the supplied film imagery. Examination of selected film imagery of the Monterey Bay and Santa Barbara Channel areas raises more questions than can be answered at this time. Density variations over water areas could be of an oceanic or atmospheric origin, or both. The ground truth acquisition phase of this project will clear up some of the apparent ambiguities, but probably not completely. A more thorough examination of meteorological parameters is recommended.

N73-16307*# Hunting Surveys, Ltd., Boreham Wood (England).
THE WORLD SURVEYED IN EIGHTEEN DAYS
Peter G. Mott, Principal Investigator [1973] 3 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(E73-10044; NASA-CR-130323) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report. Earth Resources Technology Satellite 1 was launched on July 23, 1972, on a polar orbit at an altitude of approximately 900 kilometers. The satellite circles the earth fourteen times a day, and its multispectral scanners produce complete coverage of the world every 18 days. The scanning system of the satellite is designed to provide simultaneous images if the earth's surface, each in a different spectral band-green, orange/red, red, and infrared. This data is telemetered to stations on earth where it is processed from its digital form into corrected photographic images. A single photographic exposure covers an area of 185 square kilometers. Results of ERTS-1 have far exceeded all expectations and confirm the belief that the imagery obtained will be of wide-ranging value in the study and mapping of the earth's surface. The knowledge and experience gained from the ERTS-1 data will be applied to a further study based on the much more ambitious Skylab. The improvement in the material recovered from Skylab should mark a leap forward in technical quality and in the corresponding/potential of the imagery. A.L.

N73-16308*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ERTS-1 OBSERVATIONS OF FLOOD DAMAGE IN WEST CENTRAL IOWA IN SEPTEMBER 1972
Albert Rango, V. V. Salomonson, S. Wiitala (Geol. Surv.), and P. J. Waite (NOAA) [1973] 1 p Proposed for presentation at the Spring 1973 Meeting of the Am. Geophys. Union, 16-20 Apr. 1973
(E73-10045; NASA-TM-X-68937) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-16309*# American Univ., Washington, D.C. Dept. of Biology.
ERTS IMAGE ANALYSIS. SITE: INLAND DELTA OF NIGER RIVER, REPUBLIC OF MALI, WEST AFRICA Preliminary Report
Norman H. MacLeod, Principal Investigator Jan. 1973 4 p
(Contract NAS5-21889)
(E73-10047; NASA-CR-130324; Rept-1) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-16310*# American Univ., Washington, D.C. Dept. of Biology.
ERTS IMAGE ANALYSIS Preliminary Report
Norman H. MacLeod, Principal Investigator Jan. 1973 2 p
(Contract NAS5-21892)
(E73-10048; NASA-CR-130326; Rept-1) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-16311*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LATEST RESULTS FROM THE EARTH RESOURCES PROGRAM: SUMMARY OF DISCUSSION SESSION
William Nordberg [1973] 5 p refs
(E73-10049; NASA-TM-X-68939) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report. Results are summarized of observations from the first Earth Resources Technology Satellite (ERTS-1) and interpretations of these observations in terms of surveying and mapping earth resources over large areas. The summary is based on nine reports presented to the IAF Congress on 14 October 1972.

N73-16312*# Army Coastal Engineering Research Center, Washington, D.C.
APPLICATION OF NASA ERTS-1 SATELLITE IMAGERY IN COASTAL STUDIES
Orville T. Magoon, Dennis W. Berg, Principal Investigators, and Robert J. Hallermeier [1973] 15 p refs Presented at ASCE Water Resources Conf., Washington, 29 Jan. 1973, and proposed for presentation at Goddard ERTS Symp., Greenbelt, Md., 5 Mar. 1973
(NASA Order S-70257-AG)
(E73-10050; NASA-CR-130328) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report. Review of ERTS-1 imagery indicates that it contains information of great value in coastal engineering studies. A brief introduction is given to the methods by which imagery is generated, and examples of its application to coastal engineering. Specific applications discussed include study of the movement

of coastal and nearshore sediment-laden water masses and information for planning and construction in remote areas of the world.

N73-16313*# Geological Survey, Washington, D.C.
THE CARTOGRAPHIC APPLICATION OF ERTS/RBV IMAGERY IN POLAR REGIONS Progress Report, 1 Jul. - 31 Dec. 1972
William R. MacDonald, Principal Investigator 1 Jan. 1973 4 p
(NASA Order S-70243-AG)
(E73-10051; NASA-CR-130329) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-16314*# Geological Survey, McLean, Va. Topographic Div.
AN EXPERIMENT IN CULTURAL INTERPRETATION AND MAP REVISION FROM ERTS-A DATA Progress Report, 1 Jul. - 31 Dec. 1972
William J. Kosco, Principal Investigator 1 Jan. 1973 4 p
(NASA Order S-70243-AG)
(E73-10052; NASA-CR-130330) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-16315*# Geological Survey, McLean, Va.
OVERALL EVALUATION OF ERTS-1 IMAGERY FOR CARTOGRAPHIC APPLICATION Progress Report, 1 Jul. - 31 Dec. 1972
Alden P. Colvocoresses, Principal Investigator 1 Jan. 1973 16 p
(NASA Order S-70243-AG-2)
(E73-10053; NASA-CR-130331) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Significant scientific conclusions are: (1) Bulk RBV's have internal positional accuracy in the order of 70 meters at ground scale while MSS internal accuracy is in the order of 200 to 300 meters. Both have precision processed images with accuracy within 70 meters. (2) Image quality exhibited by detectability and acutance is better than expected and perhaps twice as good as would be achieved by photographic film of the same resolution. (3) Photometric anomalies (shading) have limited RBV multispectral application, but it is believed that these anomalies can be further reduced. (4) The MSS has exceptionally high photometric fidelity but the matching of scenes taken under different conditions of illumination has not been resolved. (5) MSS bands 6 and 7 have enormous potential for surface water mapping including the correlation of shorelines at various water stages. (6) MSS band 7 demonstrates an actual cloud penetration capability beyond what was expected. It also has delineated cultural features better than the other MSS bands under certain conditions.

N73-16316*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
ERTS-A IMAGERY INTERPRETATION TECHNIQUES IN THE TENNESSEE VALLEY Progress Report
Robert E. Bodenheimer, Principal Investigator 2 Feb. 1973 4 p
(Contract NAS5-21875)
(E73-10054; NASA-CR-130332) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-16317*# Corps of Engineers, Waltham, Mass. New England Div.
THE USE OF ERTS IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Interim Report, Jun. - Dec. 1972
Saul Cooper, Principal Investigator Jan. 1973 29 p refs
(NASA Order S-70256-AG)
(E73-10055; NASA-CR-130333) Avail: NTIS HC $3.50 CSCL 08H

There are no author-identified significant results in this report. Preliminary analysis of ERTS-1 imagery suggests that the configuration and areal coverage of surface waters, as well as other hydrologically related terrain features, may be obtained from ERTS-1 imagery to an extent that would be useful. Computer-oriented pattern recognition techniques are being developed to help automate the identification and analysis of hydrologic features. Considerable man-machine interaction is required while training the computer for these tasks.

N73-16318*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
ERTS-B IMAGERY INTERPRETATION TECHNIQUES IN THE TENNESSEE VALLEY
Rafael C. Gonzalez, Principal Investigator 26 Jan. 1973 91 p refs
(Contract NAS5-21875)
(E73-10056; NASA-CR-130334) Avail: NTIS HC $6.75 CSCL 05B

There are no author-identified significant results in this report. The proposed investigation is a continuation of an ERTS-1 project. The principal missions are to serve as the principal supporter on computer and image processing problems for the multidisciplinary ERTS effort of the University of Tennessee, and to carry out research in improved methods for the computer processing, enhancement, and recognition of ERTS imagery.

N73-16319*# Geological Survey, Arlington, Va.
DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO Progress Report, 1 Sep. - 31 Oct. 1972
Edward J. Pluhowski, Principal Investigator 1 Nov. 1972 2 p
(NASA Order S-70243-AG-2)
(E73-10057; NASA-CR-130308) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N73-16320*# Geological Survey, Denver, Colo.
A STUDY OF MORPHOLOGY, PROVENANCE, AND MOVEMENT OF DESERT SAND SEAS IN AFRICA, ASIA, AND AUSTRALIA Progress Report, 1 Jul. - 31 Dec. 1972
Edwin D. McKee, Principal Investigator 1 Jan. 1973 10 p
(NASA Order S-70243-AG)
(E73-10058; NASA-CR-130335) Avail: NTIS HC $3.00 CSCL 08M

The author has identified the following significant results. The most significant result to date is recognition that complexes are indeed visible on ERTS-1 images, and that the extent and nature of dune fields in many remote areas of the world can, for the first time, be observed almost simultaneously and directly compared. The primary scientific problem is to determine accurately the relationships among certain patterns, trends, and boundaries clearly revealed on ERTS-1 imagery to true surface configurations of desert landforms, and further, to relate the defined features to controlling factors such as wind direction and intensity, moisture in the air and on the ground and barriers to sand movement. It is hoped to produce, by photographic and cartographic extraction from ERTS-1 images, a set of thematic maps that will illustrate the relationships of optical appearance of various materials and effects of the color of various sand bodies upon ERTS-1 images.

N73-16321*# Bureau of Reclamation, Denver, Colo.
MONITOR WEATHER CONDITIONS FOR CLOUD SEEDING CONTROL Progress Report, 1 Jul. - 1 Nov. 1972
Archie M. Kahan, Principal Investigator 8 Jan. 1973 2 p
(NASA Order S-70243-AG-8)
(E73-10059; NASA-CR-130309) Avail: NTIS HC $3.00 CSCL 04B

There are no author-identified significant results in this report.

N73-16322*# Geological Survey, Denver, Colo.
A STUDY OF MORPHOLOGY, PROVENANCE AND MOVEMENT OF DESERT SAND SEAS IN AFRICA, ASIA AND AUSTRALIA Progress Report, 1 Nov. - 31 Dec. 1972
Edwin D. McKee, Principal Investigator 1 Jan. 1973 6 p
(NASA Order S-70243-AG-4)
(E73-10060; NASA-CR 130310) Avail: NTIS HC $3.00 CSCL 08M

There are no author-identified significant results in this report.

N73-16323*# Bureau of Land Management, Riverside, Calif.
PREDICT EPHEMERAL AND PERENNIAL RANGE QUANTITY AND QUALITY DURING NORMAL GRAZING SEASON Progress Report, 1 Nov. - 31 Dec. 1972
Gordon Bentley, Principal Investigator 2 Jan. 1973 3 p refs

(NASA Order S-70243-AG-1)
(E73-10061; NASA-CR-130311) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-16324*# Bureau of Reclamation, Denver, Colo.
APPLICATION OF REMOTE SENSING TO SELECTED BUREAU OF RECLAMATION PROJECTS Progress Report, 1 Nov. - 31 Dec. 1972
Larry D. Cast, Principal Investigator 29 Dec. 1972 2 p
(NASA Order S-70243-AG)
(E73-10062; NASA-CR-130312) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-16325*# Geological Survey, Tacoma, Wash.
EVALUATE ERTS IMAGERY FOR MAPPING AND DETECTION OF CHANGES OF SNOWCOVER ON LAND AND ON GLACIERS Progress Report, 1 Jul. - 31 Dec. 1972
Mark F. Meier, Principal Investigator 1 Jan. 1973 14 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(NASA Order S-70243-AG)
(E73-10063; NASA-CR-130313) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. The area of snow cover on land was determined from ERTS-1 imagery. Snow cover in specific drainage basins was measured with the Stanford Research Institute console by electronically superimposing basin outlines on imagery, with video density slicing to measure areas. Snow covered area and snowline altitudes were also determined by enlarging ERTS-1 imagery 1:250,000 and using a transparent map overlay. Under very favorable conditions, snowline altitude was determined to an accuracy of about 60 m. Ability to map snow cover or to determine snowline altitude depends primarily on cloud cover and vegetation and secondarily on slope, terrain roughness, sun angle, radiometric fidelity, and amount of spectral information available. Glacier accumulation area ratios were determined from ERTS-1 imagery. Also, subtle flow structures, undetected on aerial photographs, were visible. Surging glaciers were identified, and the changes resulting from the surge of a large glacier were measured as were changes in tidal glacier termini.

N73-16326*# Geological Survey, Washington, D.C. Geographic Applications Program.
CENSUS CITIES EXPERIMENT IN URBAN CHANGE DETECTION Progress Report, 1 Jul. - 31 Dec. 1972
James R. Wray, Principal Investigator 1 Jan. 1973 8 p
(NASA Order S-70243-AG)
(E73-10064; NASA-CR-130314) Avail: NTIS HC $3.00 CSCL 05K

The author has identified the following significant results. Work continues on mapping of 1970 urban land use from 1970 census contemporaneous aircraft photography. In addition, change detection analysis from 1972 aircraft photography is underway for several urban test sites. Land use maps, mosaics, and census overlays for the two largest urban test sites are nearing publication readiness. Preliminary examinations of ERTS-1 imagery of San Francisco Bay have been conducted which show that tracts of land of more than 10 acres in size which are undergoing development in an urban setting can be identified. In addition, each spectral band is being evaluated as to its utility for urban analyses. It has been found that MSS infrared band 7 helps to differentiate intra-urban land use details not found in other MSS bands or in the RBV coverage of the same scene. Good quality false CIR composites have been generated from 9 x 9 inch positive MSS bands using the Diazo process.

N73-16327*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D. Northern Prairie Wildlife Research Center.
APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Progress Report, 1 Jul. - 31 Dec. 1972
Harvey K. Nelson, Principal Investigator 1 Jan. 1973 4 p
(NASA Order S-70243-AG)
(E73-10065; NASA-CR-130315) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-16328*# Bureau of Reclamation, Denver, Colo.
APPLICATION OF REMOTE SENSING TO SELECTED BUREAU OF RECLAMATION PROJECTS Progress Report, 1 Jul. - 31 Dec. 1972
Larry D. Cast, Principal Investigator 1 Jan. 1973 3 p
(NASA Order S-70243-AG)
(E73-10066; NASA-CR-130316) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-16329*# Geological Survey, Washington, D.C.
UTILIZATION OF ERTS-1 GENERATED PHOTOGRAPHS IN THE EVALUATION OF THE IRANIAN PLAYAS AS POTENTIAL LOCATIONS FOR ECONOMIC AND ENGINEERING DEVELOPMENT Progress Report, 1 Jul. - 31 Dec. 1972
Daniel B. Krinsley, Principal Investigator 1 Jan. 1973 4 p
(NASA Order S-70243-AG)
(E73-10067; NASA-CR-130317) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-16330*# Bureau of Land Management, Riverside, Calif. California Desert Planning Staff.
PREDICT EPHEMERAL AND PERENNIAL RANGE QUANTITY AND QUALITY DURING NORMAL GRAZING SEASON Progress Report, 1 Jul. - 1 Dec. 1972
Gordon Bentley, Principal Investigator 2 Jan. 1973 5 p
(NASA Order S-70243-AG)
(E73-10068; NASA-CR-130318) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report. Analysis of imagery made during the second and third 2-month periods has yielded little usable information for the following reasons. Imagery taken of the deserts in Arizona and California and semi-arid southeastern Oregon has been of poor quality. Because of high reflectance of light from barren desert soils, imagery is over-exposed and positive transparencies are washed out. Imagery was also taken when plants were dormant so that differences in vegetation growth and development as exhibited by changes in tone of color infrared are nonexistent.

N73-16331*# Delaware Univ., Newark. Coll. of Marine Studies.
APPLICATION OF AUTOMATED MULTISPECTRAL ANALYSIS TO DELAWARE'S COASTAL VEGETATION MAPPING
V. Klemas, Principal Investigator, D. Daiber, D. Bartlett, O. Crichton, and A. Fornes 16 Jan. 1973 6 p
(Contract NAS5-21837)
(E73-10069; NASA-CR-130355) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report. Overlay maps of Delaware's wetlands have been prepared, showing the dominant species or group of species of vegetation present. Five such categories of vegetation were used indicating marshes dominated by: (1) salt marsh cord grass; (2) salt marsh hay and spike grass; (3) reed grass; (4) high tide bush and sea myrtle; and (5) a group of fresh water species found in impounded areas built to attract water fowl. Fifteen such maps cover Delaware's wetlands from the Pennsylvania to the Maryland borders. The mapping technique employed utilizes the General Electric multispectral data processing system. This system is a hybrid asalog-digital system designed as an analysis tool to be used by an operator whose own judgment and knowledge of ground truth can be incorporated at any time into the analyzing process. The result is a high speed, cost effective method for producing enhanced photomaps showing a number of spectral classes, each enhanced spectral class being representative of a vegetative species or group of species.

N73-16332*# Argus Exploration Co., Newport Beach, Calif.
REMOTE SENSING RECONNAISSANCE OF FAULTING IN ALLUVIUM, LAKE MEAD TO LAKE HAVASU, CALIFORNIA, NEVADA AND ARIZONA. AN APPLICATION OF ERTS-1 SATELLITE IMAGERY Report of Investigation
I. C. Bechtold, Principal Investigator, M. A. Liggett, and J. F. Childs Jan. 1973 11 p refs
(Contract NAS5-21809)

(E73-10070; NASA-CR-130011) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Analysis of ERTS-1 MSS and other imagery for a 125 x 25 mile area in the southern part of the Basin-Range Province of southeastern California, southern Nevada, and northwestern Arizona indicates the presence of numerous color and contrast anomalies in alluvium. Field work guided by high altitude U-2 and side-looking aerial radar imagery confirmed that these anomalies are fault zones, many of which are believed to be of recent age. Few faults in alluvium have been reported from previous ground based geologic studies in the area. ERTS-1 imagery provides a synoptic perspective previously unavailable for regional geologic studies. The ability to conduct rapid and inexpensive reconnaissance of recent faulting has important applications to land use planning, ground water exploration, geologic hazards, and the siting and design of engineering projects.

N73-16333*# National Physical Research Lab., Pretoria (South Africa).
TO ASSESS THE VALUE OF SATELLITE IMAGERY IN RESOURCE EVALUATION ON A NATIONAL SCALE Progress Report, Jul. 1972 - Jan. 1973
O. G. Malan, Principal Investigator Feb. 1973 45 p Sponsored by NASA
(E73-10071; NASA-CR-130012; CSIR-FIS-38) Avail: NTIS HC $4.25 CSCL 05B

The author has identified the following significant results. ERTS-1 imagery of South Africa, mainly in the form of 1:1,000,000 scale black and white prints of MSS bands, was evaluated for its information content with respect to: (1) soil and terrain mapping; (2) plant ecological mapping; (3) geological mapping; and (4) urban and regional land use mapping at scales below 1:250,000. It was concluded that ERTS-1 imagery can make a significant contribution to accelerate and lower the cost of such surveys. Production of 1:500,000 color composites will remove some of the limitations encountered.

N73-16334*# Mississippi State Univ., State College.
STUDY OF APPLICATION OF REMOTE SENSING DATA TO LAND USE PLANNING ON THE MISSISSIPPI GULF COAST Interim Report, Sep. 1972 - Jan. 1973
Franklin M. Ingels, Principal Investigator and Robert W. Boyd Feb. 1973 15 p
(Contract NAS5-21817)
(E73-10072; NASA-CR-130013) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report. Comparisons are being developed for ERTS-1 imagery and data from existing land use studies of the four county area of the Mississippi Gulf Coast. ERTS-1 data will be analyzed by computer programs and land use maps will be produced which delineate categories of interest. These computer produced products will be analyzed to determine accuracy and suitability of the data for land use planning compared to the present means of data collection for such studies.

N73-16335*# California Univ., Riverside. Citrus Research Center.
EVALUATION OF REMOTE SENSING IN CONTROL OF PINK COTTON BOLLWORM
Lowell N. Lewis, Principal Investigator and Virginia B. Coleman 10 Feb. 1973 5 p
(Contract NAS5-21771)
(E73-10073; NASA-CR-130014) Avail: NTIS HC $3.00 CSCL 02A

The author has identified the following significant results. The U-2 underflight photography has shown that the critical stages in cotton plow down (defoliation, shredding, and plowing) can be identified. This result will prove invaluable to a user agency whose purpose is to monitor the cotton season for compliance with California State law.

N73-16336*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF ERTS AND EREP IMAGES TO GEOLOGIC INVESTIGATIONS OF THE BASIN AND RANGE: COLORADO PLATEAU BOUNDARY IN NORTHWESTERN AND NORTH CENTRAL ARIZONA Progress Report, 15 Oct. - 15 Dec. 1972
A. F. H. Goetz, Principal Investigator 15 Dec. 1972 4 p Sponsored by NASA
(E73-10074; NASA-CR-130015) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-16337*# Mississippi State Univ., State College. Inst. for Environmental Studies.
APPLICATION OF ERTS-A DATA TO AGRICULTURAL PRACTICES IN THE MISSISSIPPI DELTA REGION Progress Report
C. W. Bouchillon, Principal Investigator 8 Feb. 1973 5 p
(Contract NAS5-21881)
(E73-10075; NASA-CR-130016; PR-2) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N73-16338*# South Dakota State Univ., Brookings. Remote Sensing Inst.
EFFECTIVE USE OF ERTS MULTISENSOR DATA IN THE GREAT PLAINS Progress Report, period ending 31 Jan. 1973
Victor I. Myers, Principal Investigator 31 Jan. 1973 4 p
(Contract NAS5-21774)
(E73-10076; NASA-CR-130017) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. It appears that identification of corn and soybeans as separate classes may not be feasible for the part of the growing season around August 15. It is hoped that at other points in the growing season separation of corn from soybeans will be possible. Visual examination of September 5 imagery indicates that later in the growing season, it is possible. The resolution of the 1:300,000 scale enlargement remained sharp enough to distinguish features important for making soil association maps. The land use pattern (range vs cultivated) was sharp as were the stream bottoms, stream valley sides, and stock ponds. The resolution of the 1:1,000,000 scale enlargement was less sharp on detail but it appears that some features could be quantitatively analyzed. Among these are the hydrologic features present such as stock ponds and the streams. It would appear that the total area of stock pond water on a frame could be measured, and, after ground truth established their average depth, the volume of water stored could be calculated and be monitored.

N73-16339*# American Univ., Washington, D.C.
OBSERVATION OF PLANT GROWTH AND ANNUAL FLOODING IN THE INLAND DELTA OF THE NIGER RIVER, REPUBLIC OF MALI, WEST AFRICA Bimonthly Progress Report, 3 Nov. 1972 - 3 Jan. 1973
Norman H. MacLeod, Principal Investigator 3 Jan. 1973 2 p
(Contract NAS5-21892)
(E73-10078; NASA-CR-130024) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-16340*# California Univ., Los Angeles. Plasma Physics Group.
CONVECTIVE AMPLIFICATION OF TYPE 1 IRREGULARITIES IN THE EQUATORIAL ELECTROJET
K. Lee and C. F. Kennel Nov. 1972 41 p refs
(Grant NGL-05-007-190; Contract N00014-69-A-0200-4023)
(NASA-CR-130382; PPG-136) Avail: NTIS HC $4.25 CSCL 04A

Wave propagation and refraction of Type 1 irregularities in the equatorial electrojet were investigated. Quantitative calculation of wave refraction in a model electrojet showed that the direction of wave refraction must change sign at one altitude. Waves propagating with the electrons rotate their wave vectors upwards in the upper electrojet and downwards in the lower electrojet during the day, and vice versa at night. Furthermore, the altitude region of largest linear growth rate is also the one with the weakest refraction rate. Consequently, computations of the ray-path integrated wave growth shows that this region would dominate the backscatter spectrum from the electrojet if linear theory were valid, and it is further noted that the maximum amplitude wave should have phase velocities exceeding the ion acoustic speed. It was concluded that propagation alone, without

inclusion of nonlinear effects, cannot explain backscatter observations of a constant Doppler frequency shift given by the ion acoustic speed. Author

N73-16341*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
MEASUREMENTS OF THE ENERGY EXCHANGE BETWEEN EARTH AND SPACE FROM SATELLITES DURING THE 1960'S
Thomas H. Vonderhaar and Ehrhard Raschke (Bochum Univ.) Apr. 1972 29 p refs Presented at Joint Meeting of the Ger. Phys. and Meteorol. Soc., Essen, Sep. - Oct. 1971 Submitted for publication
(Grant NGR-06-002-102)
(NASA-CR-130152; Rept-184) Avail: NTIS HC $3.50 CSCL 04A

The net radiation budget of the earth-atmosphere system can be obtained from satellite measurements of the infrared radiant emittance and reflected and scattered solar radiation along with a knowledge of the solar constant. During the 1960's experimental and operational meteorological satellites carrying thermistor bolometer sensors were in orbit for about 60 months. Results from these measurements are given including: a global planetary albedo of 30%, long-term global radiation balance within measurement accuracy (2-3%), the net equator-to-pole radiation gradiants that drive our atmospheric and oceanic circulations, as well as selected measurements of radiation budget terms over particular geographical areas. Author

N73-16342*# Stanford Univ., Calif. Inst. for Plasma Research.
LINEAR AND NONLINEAR STABILITY CHARACTERISTICS OF WHISTLERS
Armando Larcher Brinca Oct. 1972 176 p refs
(Grant NGL-05-020-176)
(NASA-CR-130349; SU-IPR-489) Avail: NTIS HC $11.00 CSCL 04A

Linear and nonlinear propagating characteristics of right-hand polarized, slow electromagnetic, magnetoplasma waves (whistlers) are discussed in terms of stability and dispersion. An analysis of the stability of whistlers propagating at an angle to the static magnetic field is presented. A new mechanism is derived for the onset of stimulated emissions, and modulational instability for nonlinear whistlers are discussed. F.O.S.

N73-16343*# Stanford Univ., Calif. Inst. for Plasma Research.
POLAR CAP MAGNETIC VARIATIONS AND THEIR RELATIONSHIP WITH THE INTERPLANETARY MAGNETIC SECTOR STRUCTURE
Leif Savigaard Sep. 1972 46 p refs
(Grants NGR-05-020-559; NSF GA-31138; Contract N00014-67-A-0112-0068; NR Proj. 323-003)
(NASA-CR-130270; SU-IPR-486) Avail: NTIS HC $4.50 CSCL 08N

The relationship between polar geomagnetic variations and the polarity of the interplanetary magnetic sectors was studied for the quiet year 1965. It was found that during the day-hours a system of ionospheric currents encircles the magnetic poles on every day. The current system may extend up to 15 deg from the pole, but is strongest at 8-10 deg invariant colatitude. The current direction as seen by an observer standing on the earth is counterclockwise during interplanetary sectors with field pointing away from the sun, and clockwise during toward sectors. The current strength is dependent on season, being strongest during local summer. When the magnetic pole is on the nightside of the earth, this polar cap current is absent or very weak. When the rotation of the earth brings the magnetic pole into the dayside, the polar cap current system develops, with the current being most concentrated in the part of the current system which is nearest to the noon meridian. The current increases its total intensity until the magnetic pole is rotated past the noon meridian; then the intensity decreases as the magnetic pole approaches the nightside again. Author

N73-16344*# Stanford Univ., Calif. Radioscience Lab.
THE STRUCTURE OF THE MAGNETOSPHERE AS DEDUCED FROM MAGNETOSPHERICALLY REFLECTED WHISTLERS
Bruce Charles Edgar Mar. 1972 195 p refs
(Contract NAS5-2131; Grants NGR-05-020-288; NGL-05-020-008)
(NASA-CR-130352; SU-TR-3438-2; SU-SEL-71-070) Avail: NTIS HC $11.75 CSCL 04A

Very low frequency (VLF) electromagnetic wave phenomenon called the magnetospherically reflected (MR) whistler was investigated. VLF (0.3 to 12.5 kHz) data obtained from the Orbiting Geophysical Observatories 1 and 3 from October 1964 to December 1966 were used. MR whistlers are produced by the dispersive propagation of energy from atmospheric lightning through the magnetosphere to the satellite along ray paths which undergo one or more reflections due to the presence of ions. The gross features of MR whistler frequency-time spectrograms are explained in terms of propagation through a magnetosphere composed of thermal ions and electrons and having small density gradients across L-shells. Irregularities observed in MR spectra were interpreted in terms of propagation through field-aligned density structures. Trough and enhancement density structures were found to produce unique and easily recognizable signatures in MR spectra. Sharp cross-field density dropoff produces extra traces in MR spectrograms. Author

N73-16345*# Stanford Univ., Calif. Radioscience Lab.
METHODS OF DETERMINING ELECTRON CONCENTRATIONS IN THE MAGNETOSPHERE FROM NOSE WHISTLERS
C. G. Park Jan. 1972 113 p refs
(Grants NGL-05-020-008; NSF GA-19608; NSF GA-18128; NSF GA-28042)
(NASA-CR-130353; SU-TR-3454-1) Avail: NTIS HC $7.75 CSCL 04A

Whistler propagation in the magnetosphere was studied in detail to find accurate and economical means of determining the path latitude and the electron concentration along the path from whistler parameters of nose frequency and travel time at the nose. Longitudinal propagation in field aligned whistler ducts of cold plasma was assumed, and the earth's magnetic field was approximated by a centered dipole. The effects of whistler propagation in the earth-ionosphere waveguide and through the conjugate ionospheres were treated as small perturbations. Several alternative methods are described so that the most economical method may be chosen depending on the desired accuracy and the availability of a computer or a calculator. Author

N73-16346# Israel Program for Scientific Translations, Ltd., Jerusalem.
RIVER RUNOFF: THEORY AND ANALYSIS
D. L. Sokolovskii 1971 497 p refs Transl. into ENGLISH of the book "Rechnoistok. Osnovy Teorii i Metodiki Raschetov" Leningrad, Gidmeteorol. Izd. - vo, 1968 1971 Sponsored by ESSA and NSF
(TT-70-50058) Avail: NTIS HC $27.00

River runoff is treated from geographical, physicomathematical, hydrological and engineering viewpoints. Snowmelt and rainfall floods are discussed in detail, and the effects of swamps, forests, and agrotechnological measures on runoff conditions are considered. The determination of long-term average groundwater flow of U.S.S.R. rivers, methods for investigating patterns of annual runoff fluctuations, the use of analog computers in flood computation, and the hydrograph method, hydrological and hydrometeorological computations for irrigation system design, and methods for calculating maximum stages are also described. N.E.N.

N73-16347*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
AN ERROR ANALYSIS OF THE RECOVERY CAPABILITY OF THE RELATIVE SEA-SURFACE PROFILE OVER THE PUERTO RICAN TRENCH FROM MULTI-STATION AND SHIP TRACKING OF GEOS-2
H. R. Stanley, C. F. Martin, N. A. Roy, and J. R. Vetter May 1971 33 p refs Prepared jointly with Wolf Res. and Develop. Corp., Riverdale, Md.
(Contract NAS6-1942)
(NASA-TM-X-69353; X-300-71-1) Avail: NTIS HC $3.75 CSCL 08C

Error analyses were performed to examine the height error in a relative sea-surface profile as determined by a combination

of land-based multistation C-band radars and optical lasers and one ship-based radar tracking the GEOS 2 satellite. It was shown that two relative profiles can be obtained: one using available south-to-north passes of the satellite and one using available north-to-south type passes. An analysis of multi-station tracking capability determined that only Antigua and Grand Turk radars are required to provide satisfactory orbits for south-to-north type satellite passes, while a combination of Merritt Island, Bermuda, and Wallops radars provide secondary orbits for north-to-south passes. Analysis of ship tracking capabilities shows that high elevation single pass range-only solutions are necessary to give only moderate sensitivity to systematic error effects. Author

N73-16348*# National Aeronautics and Space Administration, Washington, D.C.
INTERNATIONAL WORKSHOP ON EARTH RESOURCES SURVEY SYSTEMS, VOLUME 1
1972 359 p refs Workshop held at Ann Arbor, Mich., 3-14 May 1971; sponsored in part by Dept. of Agr., Dept. of Interior, NOAA, Dept. of Commerce, Naval Oceanog. Office, AID, and Dept. of State
(NASA-SP-283-Vol-1; LC-72-180875) Avail: NTIS MF $0.95; SOD HC $6.00 CSCL 14B

The proceedings of a symposium on earth resources survey system are presented. The subjects discussed are: (1) aerospace methods of revealing and evaluating earth resources, (2) remote sensing in geology, hydrology, and geography, (3) applications of remote sensing in agriculture and forestry, (4) remote sensing oceanography, and (5) remote sensing of environmental quality. For individual titles, see N73-16349 through N73-16381.

N73-16349* National Aeronautics and Space Council, Washington, D.C.
THE EARTH FROM SPACE
William A. Anders *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 7-9 (For availability see N73-16348 07-13)
CSCL 08E

The effectiveness of the Earth Resources Survey Program in obtaining an overall view of the earth's land, water, and air masses is discussed. The plans for the future space programs are described with respect to their impact on the earth resources program. A brief resume of the benefits of the Apollo project to the earth resources program is included. P.N.F.

N73-16350* Geological Survey, Washington, D.C.
A LOFTY VIEW OF THE WORLD AROUND US
W. T. Pecora *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 11-14 (For availability see N73-16348 07-13)
CSCL 08E

Efforts to obtain an improved understanding of earth resources and the limits of the earth's surface are discussed. The efforts are described with respect to: (1) mapping, (2) human needs, (3) minerals, (4) water, (5) food, and (6) planning. The contributions to be made by satellites and remote sensors are reported. P.N.F.

N73-16351* National Aeronautics and Space Administration, Washington, D.C.
THE EARTH RESOURCES SURVEY PROGRAM
Leonard Jaffe *In its* Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 15-32 (For availability see N73-16348 07-13)
CSCL 08E

The operation of the Earth Resources Survey Program is discussed. The sensor systems under investigation and being used in the program are described. The specific program objectives are outlined. The roles played by spacecraft, aircraft, and ground observations are reported. Photographs and illustrations are included to amplify the text. P.N.F.

N73-16352* National Aeronautics and Space Administration, Washington, D.C.
INTERNATIONAL ASPECTS OF THE EARTH RESOURCES SURVEY PROGRAM
Arnold W. Frutkin *In its* Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 33-36 (For availability see N73-16348 07-13)
CSCL 08E

The international aspects of the Earth Resources Survey Program are presented. The three sources for obtaining earth resources data are defined. The time tables for providing earth resources data are analyzed. The cooperative agreements between foreign nations are reported. The countries which have submitted proposals for the analysis of earth resources data are identified. P.N.F.

N73-16353* Geological Survey, Washington, D.C.
AEROSPACE METHODS OF REVEALING AND EVALUATING EARTH RESOURCES
William A. Fischer *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 39-53 (For availability see N73-16348 07-13)
CSCL 08E

The design rationale for the Earth Resources Technology Satellites is presented. The user agency information needs and progress in information extraction are discussed. The ability of the ERTS system to provide repetitive data so that changes in the distribution of earth resources with time may be easily detected is emphasized. Examples of aerial photography are included to explain the data extraction processes. P.N.F.

N73-16354* Geological Survey, Washington, D.C.
REMOTE SENSING IN GEOLOGY, HYDROLOGY, AND GEOGRAPHY
Charles J. Robinove *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 55-66 (For availability see N73-16348 07-13)
CSCL 08F

The application of remote sensing from aircraft and spacecraft to acquiring data on geology, hydrology, and geography of earth areas is discussed. The facilitation of mineral resources exploration by space imagery is explained. Earth resources data obtained during the Apollo 9 flight and the Gemini flights are analyzed. The use of color infrared and black and white infrared photography for mapping and resource management is demonstrated. The organization and functions of the U.S. Geological Survey geography program are presented. P.N.F.

N73-16355* California Univ., Los Angeles.
APPLICATIONS OF REMOTE SENSING IN AGRICULTURE AND FORESTRY
Robert N. Colwell *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 67-90 refs (For availability see N73-16348 07-13)
CSCL 02F

The rationale for remote sensing of agricultural and forest resources is presented. The user requirements for information on agricultural and forest resources are examined. The procedures to be followed in conducting a resources inventory are described. The advantages of aerial and space photography for evaluating resources are analyzed. Specific examples of resource analysis are included. Author

N73-16356* National Oceanic and Atmospheric Administration, Washington, D.C.
REMOTE SENSING OCEANOGRAPHY
John W. Sherman, III *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 91-105 refs (For availability see N73-16348 07-13)
CSCL 08C

The application of electromagnetic sensors to the study of the oceans is discussed. The areas of feasible application are defined. The properties of the ocean which affect the use of electromagnetic sensors are analyzed. Examples of multispectral photography of the ocean surface and a submersible vehicle are provided. Specific references are made to: (1) ocean color analysis, (2) sea ice, (3) shoal and coastal mapping, (4) coastal marine processes, and (5) synoptic oceanography. P.N.F.

N73-16357* National Oceanic and Atmospheric Administration, Washington, D.C.
ENVIRONMENTAL MONITORING BY REMOTE SENSING FROM AIR TO SPACE

William O. Davis *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 107-118 (For availability see N73-16348 07-13)
CSCL 04A

The use of remote sensors to measure and observe all elements of the environment over the entire surface of the earth is discussed. The three areas of interest are identified as (1) short term effects which endanger life and property, (2) prediction of environmental changes, and (3) identification and management of the resources of the atmosphere, oceans, lakes, rivers, and land. Examples of aerial photography are included to show the services available for weather analysis. An example of ocean temperature distribution, as determined by Nimbus infrared sensors is presented. A schematic diagram for the organization and functions of a solar activity forecasting service is illustrated. P.N.F.

N73-16358* Geological Survey, Washington, D.C.
REMOTE SENSING OF ENVIRONMENTAL QUALITY
Gary W. North *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 119-129 (For availability see N73-16348 07-13)
CSCL 04A

A series of steps and procedures to show how remote sensing can be used to conduct regional environmental quality are defined. The objectives to be accomplished by remote sensing of environmental quality are outlined. Multispectral scanner imagery examples of various cultural features are provided. The use of remote sensors to detect water pollution and changes in water conditions is reported. Aerial photographs are provided to amplify the text. P.N.F.

N73-16359* National Aeronautics and Space Administration, Washington, D.C.
THE EARTH RESOURCES SURVEY FLIGHT PROGRAMS
Arch B. Park *In its* Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 133-137 (For availability see N73-16348 07-13)
CSCL 14B

The NASA program for Earth Resources Survey is discussed. The three space flight experiments involving ERTS-1, Skylab, and ERTS-2 are described. The payloads of the three systems are explained and their capabilities are detailed. The Earth Resources Aircraft Program is presented to show the types of aircraft involved and the equipment required to accomplish the mission. P.N.F.

N73-16360* Purdue Univ., Lafayette, Ind. Lab. for Application of Remote Sensing.
SYSTEMS APPROACH TO THE USE OF REMOTE SENSING
David A. Landgrebe *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 139-154 (For availability see N73-16348 07-13)
CSCL 14B

The earth resources information system which uses satellites as sensor platforms is discussed. The information is derived by sensing and analyzing the spectral, spatial, and temporal variations of electromagnetic fields emanating from the earth's surface. The multispectral approach and pattern recognition are described as examples of data analysis procedures for numerically oriented systems. The steps necessary in using a pattern recognition scheme are described and illustrated with data obtained from the Apollo 9 flight. Both manual and machine-aided training techniques are described for the pattern recognition algorithm. Author

N73-16361* Michigan Univ., Ann Arbor. Willow Run Labs.
HOW WILL THE NEW TECHNOLOGY ENHANCE CAPABILITIES TO COLLECT AND ANALYZE EARTH RESOURCE DATA?
Richard R. Legault *In* NASA, Washington Intern. Workshops on Earth Resources Surv. Systems, Vol. 1 1972 p 155-173 (For availability see N73-16348 07-13)
CSCL 05B

Advances in sensor technology which provide information from the ultraviolet to the microwave regions of the spectrum are discussed. The relative advantages of the various sensor systems are analyzed. The subjects discussed are: (1) single-band contrast enhancement, (2) multispectral processing, and (3) aircraft instrumentation. Aerial photographs and line drawings are included to amplify the text. P.N.F.

N73-16362* Organization of American States. Office of Regional Development.
SOME CRITERIA FOR MAKING DECISIONS TO INVEST IN RESOURCE SURVEYS, WITH SPECIAL EMPHASIS ON DEVELOPING COUNTRIES
Kirk P. Rogers *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 179-182 (For availability see N73-16348 07-13)
CSCL 08F

The political, institutional, and economic aspects of incorporating earth resources surveys into developing countires is discussed. Additional consideration is given to the: (1) geographic factors (2) data handling capabilities, and (3) identification of clearly established purpose in conducting surveys. Concepts of Latin American data collection experience are analyzed. P.N.F

N73-16363* United Nations Development Program.
BENEFIT ANALYSES AND DECISION MODELS
M. Michael Gucovsky *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1973 p 183-184 (For availability see N73-16348 07-14)
CSCL 14B

Decision models for choosing techniques and procedures to obtain information in the field of natural resources development are discussed. Two types of models: (1) type A for natural resources development and (2) type B for management of existing resources are examined. Factors affecting the efficient application of earth resources data are reported. P.N.F.

N73-16364* Comissao Nacional de Atividades Espaciais, Sao Jose Dos Campos (Brazil).
BRAZILIAN PROGRAM FOR REMOTE SENSING OF EARTH RESOURCES (PROJECT SERE)
Joao Botelho Machado *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 189-193 refs (For availability see N73-16348 07-13)
CSCL 08G

A description of the remote sensing of earth resources program being implemented in Brazil is presented. The causes of the complexity of the program are identified. The human resources and material resources assigned to the project are reported. A schematic diagram of the organizational structure is provided. Proposals for future developments are discussed. P.N.F.

N73-16365* Comissao Nacional de Atividades Espaciais, Sao Jose Dos Campos (Brazil).
REMOTE SENSING IN THE ECONOMIC MANAGEMENT OF COFFEE PRODUCTION AND MARKETING
Marcos H. Velloso *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 195-199 (For availability see N73-16348 07-13)
CSCL 02B

Experiments were conducted to test the effectiveness of color photography and infrared photography in the detection of different degrees of defoliation in a coffee crop following a severe frost attack. The relationship between defoliation and production recovery is described. The logic of a program for automatic analysis and mapping of frost damage is outlined and its use in production prediction is described. Author

N73-16366* Comissao Nacional de Atividades Espaciais, Sao Jose Dos Campos (Brazil).
THE USE OF REMOTE SENSING IN THE DETECTION OF COFFEE LEAF RUST (HEMILEIA VASTATRIX)
Marcos H. Velloso *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 201-202 (For availability see N73-16348 07-13)
CSCL 02C

The detection of Hemileia in coffee using color photography and infrared photography was conducted. Work methodology is described and the form of analysis is outlined. The use of haze filters for high altitude photography of coffee crops are recommended. The effectivness of the color scale for detecting foliage defects is analyzed. Author

N73-16367* Consejo de Recursos Naturales no Renovables, Mexico City.
SOME PRACTICAL RESULTS OF REMOTE SENSING OVER TEST SITE 701, EL ORO-TLALPUJAHUA, MEXICO
Carlos Acosta DelCampo *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 203-210 refs (For availability see N73-16348 07-13)
CSCL 08F

A comparison of imagery gathered by several remote sensors over Test Site 701 in Mexico showed the superiority of infrared or false-color film over color, panchromatic, black and white, and infrared black and white photographic emulsions in terms of reliability, economy, and speed for economic geology. The characteristics of radar imagery are discussed and the application to economic geology was found to be helpful. Examples of aerial photography are included to compare effectiveness of various processes. Author

N73-16368* Ministry of Public Works, Mexico City.
REMOTE SENSING PROGRAM AT TEST SITE 701, EL ORO-TLALPUJAHUA, MEXICO
Francisco Javier Toribio Arzate *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 211-213 (For availability see N73-16348 07-13)
CSCL 08F

A comparison was conducted of the imagery obtained by panchromatic and infrared black and white aerial photography. The imagery was used to identify highway and railroad engineering accomplishments. The analysis indicated that color and infrared color photography provided the best imagery. Plans to use radar imagery are discussed. The tests were conducted in the vicinity of Test Site 701, Mexico. Author

N73-16369* Physical Research Lab., Ahmedabad (India).
REMOTE SENSING IN INDIA
P. R. Pisharoty *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 215-218 refs (For availability see N73-16348 07-13)
CSCL 08F

A remote sensing project for the early detection of a wilt root disease affecting coconut palms in India is described. The construction of an infrared scanning camera is described. Data are presented in the form of a graph to show the intensity measurements for three conditions of palm trees. Author

N73-16370* United Nations, New York.
THE ACTIVITIES OF THE UNITED NATIONS IN THE AREA OF SPACE
Humberto Jose Ricciardi *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 219-221 (For availability see N73-16348 07-13)
CSCL 08F

The interest of the United Nations in space programs designed to assist developing nations in the development of their resources is discussed. Past efforts of the United Nations to provide earth resources information to nations requiring such data are described. The various working groups and their functions are reported. P.N.F.

N73-16371* Department of Energy, Mines and Resources, Ottawa (Ontario).
CANADA'S APPROACH TO REMOTE SENSING
L. W. Morley *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 223-234 (For availability see N73-16348 07-13)
CSCL 14B

The development of remote sensing in Canada at the federal and provincial levels is discussed. The five point program being followed to insure an adequate program are reported. An organizational chart of the interim planning committee on resource satellites and remote airborne sensing is included. The details of a proposal to NASA for earth resources project cooperation are presented. Author

N73-16372* Centre National d'Etudes Spatiales, Paris (France).
THE FRENCH TELEDETECTION PROGRAM
Aime Alouges *In* NASA, Washington Interim Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 235-236 (For availability see N73-16348 07-13)
CSCL 14B

Organizations for conducting remote sensing and earth resources projects in France are identified. Emphasis is placed on the aerial photography and photointerpretation of data for selected areas of Europe. The location of various test sites is identified and the nature of their activities is reported. P.N.F.

N73-16373* Michigan Univ., Ann Arbor.
INTRODUCTION TO SENSORS **c14**
Gwynn H. Suits *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 239-243 (For availability see N73-16348 07-13)
CSCL 14B

Various types of remote sensors are described. Important sensor types are identified as: (1) photographic camera, (2) video camera, (3) optical-mechanical scanner, and (4) microwave radar. Radiation properties which these sensors measure are summarized and their respective methods of operation are illustrated. A block diagram of a typical remote sensing system is provided. Author

N73-16374* Radio Corp. of America, New York.
TELEVISION CAMERAS **c07**
Otto H. Schade, Sr. *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 245-261 refs (For availability see N73-16348 07-13)
CSCL 17B

The characteristics of television cameras for use as remote sensors are presented. Camera design and operation are discussed in detail and illustrated by photographs. The performance of the improved television cameras is compared with that of photographic film cameras. Author

N73-16375* National Aeronautics and Space Administration. Lyndom B. Johnson Space Center, Houston, Tex.
AERIAL CAMERAS, AERIAL FILMS, AND FILM PROCESSING
Richard W. Underwood *In its* Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 263-276 refs (For availability see N73-16348 07-13)
CSCL 14E

The characteristics of aerial cameras and their employment in remote sensor investigations are reported. The development and use of the multispectral camera is discussed. The properties and applications of photographic films for various types of aerial photography are analyzed. Equipment and techniques for processing film are described. P.N.F.

N73-16376* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH OBSERVATION SENSORS **c14**
William Nordberg *In its* Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 277-281 (For availability see N73-16348 07-13)
CSCL 14B

The characteristics of sensors for earth observation are discussed. The design depends on the required sensitivity, spectral resolution, spatial resolution, and geographic coverage. Comparisons are made between the sensors for the Skylab program and those for the Earth Resources Technology Satellite. Examples of compromises in the design of sensors to meet specific requirements are examined. Author

N73-16377* Kansas Univ./Center for Research, Inc., Lawrence.
RADAR AND MICROWAVE RADIOMETRY **c07**
Richard K. Moore *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 283-301 (For availability see N73-16348 07-13)
CSCL 17I

The characteristics of radar and microwave radiometry and their application to earth resources survey activities are discussed. The use of radar for topographic mapping, geologic mapping, and geomorphic representation is described. Additional use of radar for mapping crops and natural vegetation, land use, soil moisture, and snow analysis is reported. The response of radar scatterometers and microwave radiometers to wind speed on the ocean is analyzed. Examples are provided for several uses of microwave sensors. Author

N73-16378* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE INTERPRETATION OF SPECTRAL DATA
Marvin R. Holter *In its* Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 305-325 (For availability see N73-16348 07-13)
CSCL 05B

The characteristics and extent of data which is obtainable by electromagnetic spectrum sensing and the application to earth resources survey are discussed. The wavelength and frequency ranges of operation for various remote sensors are tabulated. The spectral sensitivities of various sensing instruments are diagrammed. Examples of aerial photography to show the effects of lighting and seasonal variations on earth resources data are provided. Specific examples of multiband photography and multispectral imagery to crop analysis are included. Author

N73-16379* Geological Survey, Washington, D.C.
REMOTE SENSING AND TIME VARIANT PHENOMENA
Robert H. Alexander *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 327-341 (For availability see N73-16348 07-13)
CSCL 14B

The application of airborne remote sensors for detecting environmental changes at and near the earth's surface is discussed. The studies of environmental changes are analyzed in the context of their relationship to cyclic and evolutionary processes at work in the environment. An example is provided to illustrate ways that remote sensing monitoring systems can be incorporated into operational information systems for observing changes that take place in the course of regional or national economic development. Author

N73-16380* Geological Survey, Washington, D.C.
INTERPRETATION OF SPATIAL RELATIONSHIPS
Frederick J. Doyle *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 343-355 refs (For availability see N73-16348 07-13)
CSCL 14B

Methods for interpreting spatial relationships resulting from remote sensor data acquisition are discussed. The effect of the three factors of scale, resolution, and spatial position on the quality of the data is described. Mathematical models and diagrams are provided to explain the effects of these parameters. Techniques for automatic image correlation and ERTS image processing are diagrammed. Distortions produced by various types of remote sensors are illustrated. Author

N73-16381* Interior Dept., Washington, D.C.
INTERPRETATION BY INTERDISCIPLINARY TEAMS
W. D. Carter *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 357-366 (For availability see N73-16348 07-13)
CSCL 05B

The development and cooperation of interdisciplinary teams to find solutions to resource and environmental problems are examined. The composition of an ideal interdisciplinary team is proposed. The uses of remote sensor data for a specific test site in Arizona are tabulated. Samples of aerial photography are provided to explain the intricacies of data processing. Author

N73-16382*# National Aeronautics and Space Administration, Washington, D.C.
INTERNATIONAL WORKSHOP ON EARTH RESOURCES SURVEY SYSTEMS, VOLUME 2
1971 611 p refs Workshop held at Ann Arbor, Mich., 3-14 May 1971; sponsored in part by Dept. of Agr., Dept. of Interior, NOAA, Naval Oceanog. Office, Agency for Intern. Develop., and Dept. of State
(NASA-TM-X-68912) Avail: NTIS MF $0.95; SOD HC $5.25
CSCL 14B

For abstract see N73-16348. For individual titles, see N73-16383 through N73-16410.

N73-16383* California Univ., Berkeley. Forestry Remote Sensing Lab.
THE USE OF SMALL SCALE AERIAL PHOTOGRAPHY IN A REGIONAL AGRICULTURAL SURVEY c14
William C. Draeger *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 14 May 1971 p 2-12 refs (For availability see N73-16382 07-13)
CSCL 14E

The feasibility of performing inventories of agricultural resources using very small scale aerial or space photography has been investigated. Results to date are encouraging on two counts: (1) the questions posed initially are being answered, and (2) it would seem that a fully operational agricultural inventory using very small scale photography is not beyond the scope of present technology. The biggest problems to be faced in establishing a functional inventory system are those concerning logistics and data handling. Author

N73-16384* Agricultural Research Service, Weslaco, Tex. Soil and Water Conservation Research Div.
PHOTOGRAPHIC REMOTE SENSING OF SICK CITRUS TREES c14
Harold W. Gausman *In* NASA, Washington Intern. Workshop of Earth Resources Surv. Systems, Vol. 2 1971 p 14-30 refs (For availability see N73-16382 07-13)
CSCL 02C

Remote sensing with infrared color aerial photography (Kodak Ektachrome Infrared Aero 8443 film) for detecting citrus tree anomalies is described. Illustrations and discussions are given for detecting nutrient toxicity symptoms, for detecting foot rot and sooty mold fungal diseases, and for distinguishing among citrus species. Also, the influence of internal leaf structure on light reflectance, transmittance, and absorptance are considered; and physiological and environmental factors that affect citrus leaf light reflectance are reviewed briefly and illustrated. Author

N73-16385* California Univ., Berkeley. Forestry Remote Sensing Lab.
TESTING MULTIBAND AND MULTIDATE PHOTOGRAPHY FOR CROP IDENTIFICATION c14
D. T. Lauer *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 32-46 refs (For availability see N73-16382 07-13)
CSCL 02D

Procedures used and results derived in a series of prerequisite interpretation tests that were performed on multiband and multidate photography are described. The results of these quantitative tests led to the selection of what was considered to be the best combination of multiband and multidate photographs for use in the Maricopa County Survey. Author

N73-16386* California Univ., Berkeley. Forestry Remote Sensing Lab.
FIELD DATA COLLECTION: AN ESSENTIAL ELEMENT IN REMOTE SENSING APPLICATIONS
Lawrence R. Pettinger *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 48-64 refs (For availability see N73-16382 07-13)
CSCL 05B

Field data collected in support of remote sensing projects are generally used for the following purposes: (1) calibration of remote sensing systems, (2) evaluation of experimental applications of remote sensing imagery on small test sites, and (3) designing and evaluating operational regional resource studies and inventories which are conducted using the remote sensing imagery obtained. Field data may be used to help develop a technique for a particular application, or to aid in the application of that technique to a resource evaluation or inventory problem for a large area. Scientists at the Forestry Remote Sensing Laboratory have utilized field data for both purposes. How meaningful field data has been collected in each case is discussed. Author

N73-16387* Agricultural Research Service, Weslaco, Tex. Soil and Water Conservation Research Div.
AGRICULTURAL APPLICATIONS AND REQUIREMENTS FOR THERMAL INFRARED SCANNERS c14
Craig L. Wiegand *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 66-81 refs (For availability see N73-16382 07-13)
CSCL 02C

Some of the applications of thermal scanner data in agriculture are presented along with illustrations of some of the factors

affecting the temperature of plants, soil, and water. Examples of thermal imagery are included. Author

N73-16388* Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
FOREST AND RANGE INVENTORY AND MAPPING
Robert C. Aldrich *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 82-106 refs (For availability see N73-16382 07-13)
CSCL 08B

The state of the art in remote sensing for forest and range inventories and mapping has been discussed. There remains a long way to go before some of these techniques can be used on an operational basis. By the time that the Earth Resources Technology Satellite and Skylab space missions are flown, it should be possible to tell what kind and what quality of information can be extracted from remote sensors and how it can be used for surveys of forest and range resources. Author

N73-16389* Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
DETECTION AND CHARACTERIZATION OF STRESS SYMPTOMS IN FOREST VEGETATION
Robert C. Heller *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 108-150 refs (For availability see N73-16382 07-13)
CSCL 02F

Techniques used at the Pacific Southwest Forest and Range Experiment Station to detect advanced and previsual symptoms of vegetative stress are discussed. Stresses caused by bark beetles in coniferous stands of timber are emphasized because beetles induce stress more rapidly than most other destructive agents. Bark beetles are also the most damaging forest insects in the United States. In the work on stress symptoms, there are two primary objectives: (1) to learn the best combination of films, scales, and filters to detect and locate injured trees from aircraft and spacecraft, and (2) to learn if stressed trees can be detected before visual symptoms of decline occur. Equipment and techniques used in a study of the epidemic of the Black Hills bark beetle are described. Author

N73-16390* Northern Forest Fire Lab., Missoula, Mont.
APPLICATION OF INFRARED SCANNERS TO FOREST FIRE DETECTION c14
Stanley N. Hirsch *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 152-169 refs (For availability see N73-16382 07-13)
(Proj. Fire Scan)
CSCL 02F

The potential of using infrared scanners for the detection of forest fires is discussed. An experiment is described in which infrared and visual detection systems were used jointly to study timber fire detection. Many fires were detected visually but missed by the airborne IR system, and many fires were detected by the IR system but missed visually. Until more is learned about the relationship between heat output and smoke output from latent fires, the relative effectiveness of visual and IR systems cannot be determined. The 1970 tests indicated that IR used in combination with visual detection will result in a more efficient system than visual alone. Even with limited knowledge of the relative effectiveness of the two systems, operational use of a combined system can be used to substantially reduce total firefighting costs. A.L.

N73-16391* Geological Survey, McLean, Va. Topographic Div.
APPLICATION OF REMOTE SENSING TO PLANIMETRIC, THEMATIC, AND TOPOGRAPHIC MAPPING
John D. McLaurin *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 170-194 refs (For availability see N73-16382 07-13)
CSCL 08B

Results of studies indicate some of the potential applications of space photography to mapping. The imagery used was not optimum for mapping purposes, and there is considerable room for improvement. The ERTS A and B satellites are expected to provide imagery that will be useful for small scale mapping, both planimetric and thematic. The repetitive coverage capability will certainly be useful for monitoring changing phenomena. However, to solve the world mapping problems, other imaging systems will have to be flown. Film-return satellites and geosynchronous satellites may have to be used together with aircraft to provide imagery for rapid and efficient mapping operations. Until such systems are in use on a worldwide basis, there is little likelihood that the planimetric and topographic map needs, particularly of the developing countries, will be met. Author

N73-16392* Florida Univ., Gainesville.
REGIONAL LAND USE MAPPING: THE PHOENIX PILOT PROJECT
James R. Anderson and John L. Place (Geol. Surv.) *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 196-210 refs (For availability see N73-16382 07-13)
CSCL 08B

The Phoenix Pilot Program has been designed to make effective use of past experience in making land use maps and collecting land use information. Conclusions reached from the project are: (1) Land use maps and accompanying statistical information of reasonable accuracy and quality can be compiled at a scale of 1:250,000 from orbital imagery. (2) Orbital imagery used in conjunction with other sources of information when available can significantly enhance the collection and analysis of land use information. (3) Orbital imagery combined with modern computer technology will help resolve the problem of obtaining land use data quickly and on a regular basis, which will greatly enhance the usefulness of such data in regional planning, land management, and other applied programs. (4) Agreement on a framework or scheme of land use classification for use with orbital imagery will be necessary for effective use of land use data. Author

N73-16393* Iowa Univ., Iowa City. Inst. of Urban and Regional Research.
THE APPLICATION OF REMOTE SENSING TECHNIQUES TO URBAN DATA ACQUISITION c34
Frank E. Horton *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 212-223 refs (For availability see N73-16382 07-13)
CSCL 05K

The application of remote sensing techniques useful in acquiring data concerning housing quality is discussed. Conclusions reached from the investigation were: (1) Use of individuals with a higher degree of training in photointerpretation should significantly increase the percentage of successful classifications. (2) Small area classification of urban housing quality can definitely be accomplished via high resolution aerial photography. Such surveys, at the levels of accuracy demonstrated, can be of major utility in quick look surveys. (3) Survey costs should be significantly reduced. A.L.

N73-16394* California Univ., Riverside. Dept. of Geography.
CLIMATOLOGY OF URBAN-REGIONAL SYSTEMS c20
Robert W. Pease *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 224-240 refs (For availability see N73-16382 07-13)
CSCL 04B

Urbanized areas have come to be significant if not dominant components of many regional land surfaces. They represent perhaps the most dramatic recent change man has made in his environment - a change that may well burgeon in the foreseeable future as greater percentages of world populations crowd into metropolitan areas. The climate of urban-regional systems is involved because temperature, air, and pollutants added to the air are significant aspects of this change. During the past two years, substantial progress has been made in the application of remote sensing techniques to the study of urban climatology by programs jointly sponsored by NASA and the United States Geological Survey. The initial effort has endeavored with considerable success to map terrestrial radiation emission or the general thermal state of the land surface with the aid of imaging radiometers (mechanical-optical scanners). Author

N73-16395* Geological Survey, Washington, D.C.
CENSUS CITIES PROJECT AND ATLAS OF URBAN AND REGIONAL CHANGE c34

James R. Wray *In* NASA, Washington Intern. Worskhop on Earth Resources Surv. Systems, Vol. 2 1971 p 242-259 (For availability see N73-16382 07-13)
CSCL 05K

The Census Cities Project has several related purposes: (1) to assess the role of remote sensors on high altitude platforms for the comparative study of urban areas; (2) to detect changes in selected U.S. urban areas between the 1970 census and the time of launching of an earth-orbiting sensor platform prior to the next census; (3) to test the utility of the satellite sensor platform to monitor urban change (When the 1970 census returns become available for small areas, they will serve as a control for sensor image interpretation.); (4) to design an information system for incorporating graphic sensor data with census-type data gathered by traditional techniques; (5) to identify and design user-oriented end-products or information services; and (6) to plan an effective organizational capability to provide such services on a continuing basis. Author

N73-16396* Geological Survey, Washington, D.C.
APPLICATION OF REMOTE SENSING TECHNIQUES FOR APPRAISING CHANGES IN WILDLIFE HABITAT c04
Harvey K. Nelson (Northern Prairie Wildlife Res. Center), A. T. Klett (Northern Prairie Wildlife Res. Center), and John E. Johnston *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 260-288 refs (For availability see N73-16382 07-13)
CSCL 02E

An attempt was made to investigate the potential of airborne, multispectral, line scanner data acquisition and computer-implemented automatic recognition techniques for providing useful information about waterfowl breeding habitat in North Dakota. The spectral characteristics of the components of a landscape containing waterfowl habitat can be detected with airborne scanners. By analyzing these spectral characteristics it is possible to identify and map the landscape components through analog and digital processing methods. At the present stage of development multispectral remote sensing techniques are not ready for operational application to surveys of migratory bird habitat and other such resources. Further developments are needed to: (1) increase accuracy; (2) decrease retrieval and processing time; and (3) reduce costs. A.L.

N73-16397* Geological Survey, Washington, D.C.
REMOTE SENSING OF ENVIRONMENTAL POLLUTION
Gary W. North *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 290-301 (For availability see N73-16382 07-13)
CSCL 04A

Environmental pollution is a problem of international scope and concern. It can be subdivided into problems relating to water, air, or land pollution. Many of the problems in these three categories lend themselves to study and possible solution by remote sensing. Through the use of remote sensing systems and techniques, it is possible to detect and monitor, and in some cases, identify, measure, and study the effects of various environmental pollutants. As a guide for making decisions regarding the use of remote sensors for pollution studies, a special five-dimensional sensor/applications matrix has been designed. The matrix defines an environmental goal, ranks the various remote sensing objectives in terms of their ability to assist in solving environmental problems, lists the environmental problems, ranks the sensors that can be used for collecting data on each problem, and finally ranks the sensor platform options that are currently available. Author

N73-16398* TRW Systems Group, Redondo Beach, Calif.
REMOTE SENSING OF WATER POLLUTION
Peter G. White *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 302-321 (For availability see N73-16382 07-13)
CSCL 08H

Remote sensing, as a tool to aid in the control of water pollution, offers a means of making rapid, economical surveys of areas that are relatively inaccessible on the ground. At the same time, it offers the only practical means of mapping pollution patterns that cover large areas. Detection of oil slicks, thermal pollution, sewage, and algae are discussed. Author

N73-16399* Geological Survey, Washington, D.C.
SATELLITE RELAY TELEMETRY OF SEISMIC DATA IN EARTHQUAKE PREDICTION AND CONTROL c07
Wayne H. Jackson and Jerry P. Eaton *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 322-343 (For availability see N73-16382 07-13)
CSCL 09F

The Satellite Telemetry Earthquake Monitoring Program was started to evaluate the applicability of satellite relay telemetry in the collection of seismic data from a large number of dense seismograph clusters laid out along the major fault systems of western North America. Prototype clusters utilizing phone-line telemetry were then being installed by the National Center for Earthquake Research in 3 regions along the San Andreas fault in central California; and the experience of installing and operating the clusters and in reducing and analyzing the seismic data from them was to provide the raw materials for evaluation in the satellite relay telemetry project. The principal advantages of the satellite relay system over commercial telephone or microwave systems were: (1) it could be made less prone to massive failure during a major earthquake; (2) it could be extended readily into undeveloped regions; and (3) it could provide flexible, uniform communications over large sections of major global tectonic zones. Fundamental characteristics of a communications system to cope with the large volume of raw data collected by a short-period seismograph network are discussed. Author

N73-16400* Geological Survey, Denver, Colo.
AUTOMATIC COMPUTER MAPPING OF TERRAIN
Harry W. Smedes *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 344-406 refs Sponsored in part by NASA (For availability see N73-16382 07-13)
CSCL 08B

Computer processing of 17 wavelength bands of visible, reflective infrared, and thermal infrared scanner spectrometer data, and of three wavelength bands derived from color aerial film has resulted in successful automatic computer mapping of eight or more terrain classes in a Yellowstone National Park test site. The tests involved: (1) supervised and non-supervised computer programs; (2) special preprocessing of the scanner data to reduce computer processing time and cost, and improve the accuracy; and (3) studies of the effectiveness of the proposed Earth Resources Technology Satellite (ERTS) data channels in the automatic mapping of the same terrain, based on simulations, using the same set of scanner data. The following terrain classes have been mapped with greater than 80 percent accuracy in a 12-square-mile area with 1,800 feet of relief: (1) bedrock exposures, (2) vegetated rock rubble, (3) talus, (4) glacial kame meadow, (5) glacial till meadow, (6) forest, (7) bog, and (8) water. In addition, shadows of clouds and cliffs are depicted, but were greatly reduced by using preprocessing techniques. Author

N73-16401* Geological Survey, Denver, Colo.
GEOPHYSICAL ASPECTS OF REMOTE SENSING
Kenneth Watson *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 408-428 refs (For availability see N73-16382 07-13)
CSCL 08F

Results obtained through the NASA Earth Resources Aircraft Program at Mill Creek, Oklahoma, provide a case history example of the application of remote sensing to the identification of geologic rock units. Thermal infrared images are interpreted by means of a sequence of models of increasing complexity. The roles of various parameters are examined: rock properties (thermal inertia, albedo, emissivity), site location (latitude), season (sun's declination), atmospheric effects (cloud cover, transmission, air temperature), and topographic orientation (slope, azimuth). The results obtained at this site also illustrate the development of an important application of remote sensing in geologic identification. Relatively pure limestones and dolomites of the Mill Creek test area can be differentiated in nighttime infrared images, and facies changes between them can be detected along and across strike. The predominance on the earth's surface of sedimentary rocks, of which limestone and dolomite are major members, indicates the importance of this discrimination. Author

N73-16402* National Oceanic and Atmospheric Administration, Washington, D.C.
REMOTE SENSING OF SNOW FIELDS FROM EARTH SATELLITES
Donald R. Baker *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 430-440 refs (For availability see N73-16382 07-13)
CSCL 08L

Considerable effort has gone into snow line delineation using available satellite data. Furthermore, increasing emphasis is being put on automated extraction of such information and generation of a useable product for hydrologists. Implications are clear that the impact from future satellite and sensors systems will create an increased demand for computer processing before the data can be used by the hydrologist. If the coarse-resolution, broad spectral band data available from current satellites already create a demand by hydrologists for computer processing of the data, it is obvious there will be an even greater demand for computer analysis and evaluation when the future ERTS data become available. Author

N73-16403* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NIMBUS 3 AND 4 OBSERVATIONS OF SNOW COVER AND OTHER HYDROLOGICAL FEATURES IN THE WESTERN HIMALAYAS
Vincent V. Salomonson *In its* Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 442-447 (For availability see N73-16382 07-13)
CSCL 08L

Photographs from the Nimbus 3 and 4 image dissector camera systems and high resolution infrared radiometers illustrate and demonstrate their applicability in observing snow cover and other hydrological features. This collection of imagery shows the relative merits of daily observations of these features in the visible, near infrared, and far infrared portions of the electromagnetic spectrum with sensors having nominal spatial resolutions between 4 and 8 kilometers. Particular emphasis has been placed on observing features associated with the Indus River because of the economic and social importance of this in the lives of millions of people. The overall results clearly indicate that it is feasible to monitor quantitatively the extent of the snow cover over the Indus River watershed during a given year and from one year to another using meteorological satellite imagery.
Author

N73-16404* Geological Survey, Harrisburg, Pa.
THE ROLE OF REMOTELY SENSED AND RELAYED DATA IN THE DELAWARE RIVER BASIN
Richard W. Paulson *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 448-467 refs (For availability see N73-16382 07-13)
CSCL 08H

The planned integration of the existing water quality monitoring and data processing systems in the Delaware River Basin with a data relay experiment proposed for the ERTS-1 is discussed. The experiment is designed to use ERTS-1 as a data relay link for a maximum of 20 hydrologic stations in the basin, including stream gaging, reservoir level, ground water level, and water quality monitoring stations. This experiment has the potential for reducing the time lag between data collection and dissemination to less than 12 hours. The experiment will also provide impetus to develop an operational system of real time data processing and dissemination to handle the large quantity of data that will be obtained from the stations in the basin. The results of this experiment will demonstrate the relative merits of satellite relay of data versus conventional means of data telemetry and will provide a basis for the development of operational satellite relay of hydrologic data. Author

N73-16405* Allied Research Associates, Inc., Lanham, Md.
HYDROLOGIC CONDITIONS VIEWED BY THE NIMBUS METEOROLOGICAL SATELLITES
George A. Rabchevsky *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 468-511 refs (For availability see N73-16382 07-13)
CSCL 08H

The unexploited value of the Nimbus meteorological sensor data relates to the satellites' ability for global, temporal, repetitive and uniform tonal and spatial coverage of the earth's surface. Examples are presented illustrating how synoptic views of large areas increase interpretive capability and enable focusing on large targets of interest. The effect of resolution of the Nimbus imaging systems on these observations is discussed, together with the assessment of the areal and temporal magnitude of changes observed by these systems. Two case studies are presented exemplifying the satellites' ability for repetitive observations enabling phenomena to be monitored under special conditions. One study deals with changes observed in the Antarctic ice conditions utilizing the Nimbus 2 and 3 television picture data. The other study deals with terrestrial changes in the Mississippi River Valley and the Niger River Valley (Africa), observed primarily in the 0.7 to 1.3 micron spectral band. Author

N73-16406* Geological Survey, Tucson, Ariz.
MEASUREMENT OF SPATIAL AND TEMPORAL CHANGES IN VEGETATION FROM COLOR-IR FILM
Raymond M. Turner *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 512-525 refs (For availability see N73-16382 07-13)
CSCL 08F

The use of color infrared film to measure spatial and temporal changes in vegetation is discussed. The subjects presented are: (1) selection of the sensor, (2) collection of the data, and (3) analysis of the data. The effects of climatology and meteorological parameters on interpretation of the data are analyzed. It is concluded that the color infrared film will enhance the imagery of green plants and will accentuate differences between plants. Author

N73-16407* Scripps Institution of Oceanography, La Jolla, Calif.
EXPLORATION OF MARINE RESOURCES BY PHOTOGRAPHIC REMOTE SENSING
Seibert Q. Duntley, Robert E. Stevenson (ONR), and Almerian R. Boileau *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 526-550 (For availability see N73-16382 07-13)
CSCL 08C

The interpretation of photographs in oceanographic remote sensing is discussed. The photographs were made from spacecraft with two exceptions. Two photographs were made from aircraft. There were three types of film used to make the photographs: black-and-white, color, and color IR. Black and white photography is well known; it presents pictures in various shades of gray from black to white. Color film presents pictures in color, very nearly as the human eye sees them. Color IR film presents pictures in color also but not as seen by the human eye. Blue becomes much deeper blue, green is suppressed to some extent, and red is recorded beyond the visual range of the human eye, out in the near infrared. The most noticeable effect of the use of color IR film is that leaf materials which are highly reflective in the infrared part of the spectrum are presented as red.
Author

N73-16408* Naval Oceanographic Office, Washington, D.C.
OCEANOGRAPHIC INTERPRETATION OF APOLLO PHOTOGRAPHS. COASTAL OCEANOGRAPHIC AND SEDIMENTOLOGIC INTERPRETATION OF APOLLO 9 SPACE PHOTOGRAPHS; CAROLINA'S CONTINENTAL SHELF, USA
Robert L. Mairs *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 552-579 refs (For availability see N73-16382 07-13)
CSCL 08C

Apollo 9 photographs, color band separations, and oceanographic and meteorological data are used in the study of the origin, movement, and dissipation of masses of discolored water near the shores of North and South Carolina. A model has been developed incorporating jet theory, climatology, currents, surface temperatures, color separations, and other oceanographic data to explain the processes involved in the life cycle of the discolored water masses. Special treatment is afforded the Gulf Stream boundary definition and the Cape Hatteras oceanographic barrier. Author

N73-16409* National Environmental Satellite Service, Washington, D.C.

REMOTE SENSING OF SEA ICE FROM EARTH SATELLITES
E. Paul McClain *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 580-593 refs (For availability see N73-16382 07-13)
CSCL 08L

The application of meteorological satellite data for mapping ice fields is discussed. The characteristics of the photographic records of sea ice formations are described. The derivation of the composite minimum brightness chart by computer processing of the mapped satellite vidicon data for several successive days is explained. The factors which create a quantitative delimiting of the sea ice conditions are explained. Author

N73-16410* National Environmental Satellite Service, Washington, D.C.
REMOTE SENSING OF SEA SURFACE TEMPERATURE FROM EARTH SATELLITES
P. Krishna Rao *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 594-606 refs (For availability see N73-16382 07-13)
CSCL 08J

Techniques for measuring sea surface temperature using remote sensors in earth orbiting satellites are discussed. Specific reference is made to the infrared sensors carried by the TIROS Operational Satellite. The development of a method to examine a large number of measurements in order to differentiate the temperature effects of clouds is described. It is stated that the system used is completely objective and minimizes the influence of atmospheric absorption, cloud contamination, and instrumental noise on the inferred sea surface temperatures. Author

N73-16411# Kakioka Magnetic Observatory (Japan).
GEOMAGNETIC AND GEOELECTRIC OBSERVATIONS, 1971 (RAPID VARIATIONS)
1972 91 p
(Rept-12) Avail: NTIS HC $6.75

Tables are presented of measurements made at Kakioka Magnetic Observatory, Japan, of magnetic storms, magnetic sudden impulses, magnetic bays, magnetic solar flare effects, and magnetic pulsations for the Post-IGC, 1971. Some copies of records of the rapid-run induction magnetograms and tellurigrams in 1971 are also included. A.L.

N73-16412# Department of the Environment, Ottawa (Ontario). Ice and Snow Research Committee.
REVIEW OF CURRENT ICE TECHNOLOGY AND EVALUATION OF RESEARCH PRIORITIES
1971 312 p refs
(Rept-17) Avail: NTIS HC $17.75

This report is intended to assist in achieving the objective of a well-designed research program. In it, various ice problems in Canada are examined, and, where possible, the economic significance of these problems is estimated. From this information an order of priorities of research has been obtained in the form of a set of overall programs of research. Author

N73-16413# National Physical Lab., New Delhi (India). Radio Science Div.
ELECTRON COOLING IN THE F2-REGION AT LOW AND MID-LATITUDES
K. K. Mahajan and Sudesh Kumari May 1972 15 p refs
(RSD-74; SR-74) Avail: NTIS HC $3.00

Experimentally observed electron concentration, electron temperature, and ion temperature profiles, for ionospheric conditions corresponding to low and middle latitudes, are used to calculate the electron cooling rates arising from the two major cooling mechanisms in the F2 region (electron-ion collisions and electron impact induced transitions). When electron concentration is low, the cooling due to fine structure excitation of atomic oxygen dominates, and conversely, when electron concentration is high, the cooling due to oxygen ions dominates. For midlatitudes, the electron concentration rarely exceeds 5 x 10 to the 5th power cu cm and so for these latitudes the dominant cooling mechanism is the fine structure excitation of atomic oxygen. Author

N73-16414# National Physical Lab., New Delhi (India). Radio Science Div.
ANOMALOUS BEHAVIOR OF F-REGION DURING SOLAR ECLIPSE OF 22 SEPTEMBER 1968
R. Venkatachari and L. H. Sarma May 1972 19 p refs
(RSD-73; SR-73) Avail: NTIS HC $3.00

Effects observed on ionograms and in cosmic radio noise absorption at Delhi for the eclipse of September 22, 1968 (maximum obscuration 81% at ground) are presented. Both foF2 and cosmic noise absorption showed anomalous increase during the eclipse. The implications of these observations are discussed. Estimation of electron temperature changes in the F region from absorption mesurements indicate a decrease near the maximum of the eclipse. Author

N73-16415# National Physical Lab., New Delhi (India). Radio Science Div.
A STUDY OF THE EQUATORIAL D-REGION
Y. V. Somayajulu, M. B. Avadhanulu, and K. S. Zalpuri Jun. 1973 19 p refs Presented at COSPAR Symp., Madrid, May 1972
(RSD-76) Avail: NTIS HC $3.00

The electron density profiles in the D region obtained by rocket sounding at the geomagnetic equator are briefly reviewed. The transition from cosmic ray to Lyman alpha is shown as the dominant ionization source occuring at an altitude between 65 and 70 km. The observed behavior is found to be consistent with the current concepts of ionization production by Lyman alpha radiation and cosmic rays in the D region. These experimental electron density profiles are utilized to develope a diurnal model of the equatorial D region. Author

N73-16416*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHOTOELECTRON ESCAPE FLUXES OVER THE EQUATORIAL AND MIDLATITUDE REGIONS
B. C. NarasingaRao, Risal Singh, and E. J. Maier Jun. 1972 20 p refs Submitted for publication Prepared in cooperation with Natl. Phys. Lab., New Delhi
(NASA-TM-X-68921; RSD-75) Avail: NTIS HC $3.00 CSCL 04A

Satellite measurements of photoelectron escape flux around noontime made by Explorer 31 in 600-800 km altitude range are reported for the equatorial and midlatitude regions. The pitch angle distributions and the spectral distributions are derived from the data. Analyzed data show that the flux for equatorial regions is lower by a factor 2 to 3 in comparison to that of midlatitude regions. Theoretical calculations are also made to compare with observed escape fluxes. Author

N73-16417# National Physical Lab., New Delhi (India). Radio Science Div.
ON THE POSSIBILITY OF DEVELOPING THEORETICAL MODELS OF THE DISTURBED F-REGION
Y. V. Somayajulu Jul. 1972 15 p refs Presented at Conf. on Ionospheric Models, University Park, Pa., 15-18 Jun. 1971
(RSD-77; SR-77) Avail: NTIS HC $3.00

The observed features of the disturbed F-region, obtained from groundbased and spaceborne experiments, are briefly summarized. An attempt is made to examine the possibility of developing theoretical models of the disturbed F-region. It is concluded that while the techniques for generating theoretical models of the F-region are fairly well developed, knowledge of the disturbed F-region is, by and large, qualitative and inadequate for specifying the necessary inputs for modelling. Author

N73-16418# Osservatorio Geofisico Sperimentale, Trieste (Italy).
REGIONAL REFLECTION SEISMIC EXPLORATION OF THE STRAIT OF SICILY
I. Fingetti and C. Morelli [1973] 16 p refs Sponsored by CNR
(SACLANTCEN-Conf-Proc-7; Contrib-212) Avail: NTIS HC $3.00

A regional seismic reflection survey was performed in 1970 on the Sicily Channel, using multichannel digital techniques and flexotir source. Reflections up to about 5 s (two-way time) were obtained. Velocity functions and correlations were analyzed with the geological data to indicate the geological attribution of the most continuous and characteristic reflectors from Miocene to Trias, and to recognize a thick sedimentary platform sequence

which dominates the Strait without continuity from North Africa to southern Sicily. Author

N73-16419# Hawaii Univ., Honolulu. Radioscience Lab.
ATLAS OF TOTAL ELECTRON CONTENT PLOTS. VOLUME 7: 1 JANUARY - 31 DECEMBER 1971
Paul C. Yuen and Thomas H. Roelofs [1972] 261 p refs
(Grants NSF GP-5404; NSF GA-1113; NSF GA-7330)
Avail: NTIS HC $15.25 CSCL 04A

Diurnal plots reported show the total electron content versus time as obtained at Hawaii by measuring the Faraday rotation of the polarization of VHF telemetry carrier transmission from the geostationary satellite ATS-1. Data are plotted in Hawaiian standard time and include monthly averages. Author

N73-16420*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
CHANGES OF MULTISPECTRAL SOIL PATTERNS WITH INCREASING CROP CANOPY
S. J. Kristof and M. F. Baumgardner [1972] 31 p refs
(Grant NGL-15-005-112)
(NASA-CR-130035; LARS-Print-102372; J-Paper-4927) Avail: NTIS HC $3.75 CSCL 08M

Multispectral data and automatic data processing were used to map surface soil patterns and to follow the changes in multispectral radiation from a field of maize (Zea mays L.) during a period from seeding to maturity. Panchromatic aerial photography was obtained in early May 1970 and multispectral scanner missions were flown on May 6, June 30, August 11 and September 5, 1970 to obtain energy measurements in 13 wavelength bands. The orange portion of the visible spectrum was used in analyzing the May and June data to cluster relative radiance of the soils into eight different radiance levels. The reflective infrared spectral band was used in analyzing the August and September data to cluster maize into different spectral categories. The computer-produced soil patterns had a striking similarity to the soil pattern of the aerial photograph. These patterns became less distinct as the maize canopy increased. Author

N73-16421*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DETERMINING DENSITY OF MAIZE CANOPY. 3: TEMPORAL CONSIDERATIONS
E. R. Stoner, M. F. Baumgardner, P. E. Anuta, and J. E. Cipra [1972] 33 p refs
(Grant NGL-15-005-112)
(NASA-CR-130369; LARS-Print-111372; J-Paper-4931) Avail: NTIS HC $3.75 CSCL 20C

Multispectral scanner data were collected in two flights over ground cover plots at an altitude of 305 m. Eight ground reflectance panels in close proximity to the ground cover plots were used to normalize the scanner data obtained on different dates. Separate prediction equations were obtained for both flight dates for all eleven reflective wavelength bands of the multispectral scanner. Ratios of normalized scanner data were related to leaf area index over time. Normalized scanner data were used to plot relative reflectance versus wavelength for the ground cover plots. Spectral response curves were similar to those for bare soil and green vegetation as determined by laboratory measurements. The spectral response curves from the normalized scanner data indicated that reflectance in the 0.72 to 1.3 micron wavelength range increased as leaf area index increased. A decrease in reflectance was observed in the 0.65 micron chlorophyll absorption band as leaf area index increased. Author

N73-16422*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DETERMINING DENSITY OF MAIZE CANOPY. 1: DIGITIZED PHOTOGRAPHY
E. R. Stoner, M. F. Baumgardner, and P. H. Swain [1972] 26 p refs
(Grant NGL-15-005-112)
(NASA-CR-130370; LARS-Print-111172; J-Paper-4929) Avail: NTIS HC $3.50 CSCL 14E

The relationship between different densities of maize (Zea mays L.) canopies and the energy reflected by these canopies was studied. Field plots were laid out, representing four growth stages of maize, on a dark soil and on a very light colored surface soil. Spectral and spatial data were obtained from color and color infrared photography taken from a vertical distance of 10 m above the maize canopies. Estimates of ground cover were related to field measurements of leaf area index. Ground cover was predicted from leaf area index measurements by a second order equation. Color infrared photography proved helpful in determining the density of maize canopy on dark soils. Color photography was useful for determining canopy density on light colored soils. The near infrared dye layer is the most valuable in canopy density determinations. Author

N73-16423*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
ADP OF MULTISPECTRAL SCANNER DATA FOR LAND USE MAPPING
Roger M. Hoffer [1971] 26 p refs
(Grant NGL-15-005-112)
(NASA-CR-130372; LARS-Inform-Note-080372) Avail: NTIS HC $3.50 CSCL 08B

The advantages and disadvantages of various remote sensing instrumentation and analysis techniques are reviewed. The use of multispectral scanner data and the automatic data processing techniques are considered. A computer-aided analysis system for remote sensor data is described with emphasis on the image display, statistics processor, wavelength band selection, classification processor, and results display. Advanced techniques in using spectral and temporal data are also considered. N.E.N.

N73-16424*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
APPLICATION OF MULTISPECTRAL REMOTE SENSING TO SOIL SURVEY RESEARCH IN INDIANA
A. L. Zachary, J. E. Cipra, R. I. Diderickson, S. J. Kristof, and M. F. Baumgardner [1972] 13 p refs
(Grant NGL-15-002-112)
(NASA-CR-130033; LARS-Print-110972) Avail: NTIS HC $3.00 CSCL 08M

Computer-implemented mappings based on spectral properties of bare soil surfaces were compared with mapping units of interest to soil surveyors. Some soil types could be differentiated by their spectral properties. In other cases, soils with similar surface colors and textures could not be distinguished spectrally. The spectral maps seemed useful for delineating boundaries between soils in many cases. Author

N73-16425*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DETERMINING DENSITY OF MAIZE CANOPY. 2: AIRBORNE MULTISPECTRAL SCANNER DATA
E. R. Stoner, M. F. Baumgardner, and J. E. Cipra [1971] 17 p refs
(Grant NGL-15-005-112)
(NASA-CR-130363; LARS-Print-111272; J-Paper-4930) Avail: NTIS HC $3.00 CSCL 14E

Multispectral scanner data were collected in two flights over a light colored soil background cover plot at an altitude of 305 m. Energy in eleven reflective wavelength band from 0.45 to 2.6 microns was recorded. Four growth stages of maize (Zea mays L.) gave a wide range of canopy densities for each flight date. Leaf area index measurements were taken from the twelve subplots and were used as a measure of canopy density. Ratio techniques were used to relate uncalibrated scanner response to leaf area index. The ratios of scanner data values for the 0.72 to 0.92 micron wavelength band over the 0.61 to 0.70 micron wavelength band were calculated for each plot. The ratios related very well to leaf area index for a given flight date. The results indicated that spectral data from maize canopies could be of value in determining canopy density. Author

N73-16426*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MOMENT EXPANSION FOR IONOSPHERIC RANGE ERROR
A. Mallinckrodt, R. Reich, H. Parker, and J. Berbert Aug. 1972 59 p refs Presented at the USNC/URSI Meeting, Washington, D. C., 13-15 Apr. 1972 Prepared jointly with Commun. Res. Labs. and RCA Serv. Co., Camden, N. J.
(Contracts NAS5-21728; NAS5-10600)

(NASA-TM-X-66159; X-550-72-298) Avail: NTIS HC $5.00 CSCL 04A

On a plane earth, the ionospheric or tropospheric range error depends only on the total refractivity content or zeroth moment of the refracting layer and the elevation angle. On a spherical earth, however, the dependence is more complex; so for more accurate results it has been necessary to resort to complex ray-tracing calculations. A simple, high-accuracy alternative to the ray-tracing calculation is presented. By appropriate expansion of the angular dependence in the ray-tracing integral in a power series in height, an expression is obtained for the range error in terms of a simple function of elevation angle, E, at the expansion height and of the mth moment of the refractivity, N, distribution about the expansion height. The rapidity of convergence is heavily dependent on the choice of expansion height. For expansion heights in the neighborhood of the centroid of the layer (300-490 km), the expansion to N = 2 (three terms) gives results accurate to about 0.4% at E = 10 deg. As an analytic tool, the expansion affords some insight on the influence of layer shape on range errors in special problems. Author

N73-16427*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE DETERMINATION OF THE HARMONIC COMPONENTS OF THE DIURNAL VARIATION OF THE THERMOSPHERE FROM SATELLITE DRAG DATA

Peter W. Blum Nov. 1972 8 p refs Submitted for publication (NASA-TM-X-66160; X-621-72-501) Avail: NTIS HC $3.00 CSCL 04A

The accuracy of the diurnal and semidiurnal harmonics of density variation determined from satellite drag data is discussed and compared with data from the Jacchia empirical atmospheric model. The phase discrepancies between densities and temperatures, which are more pronounced in summer, and the extrema of the density data are described. The ratio of the semidiurnal to diurnal component of kinetic temperature, determined from Salah and Evans incoherent scatter radar observations, also indicates a seasonal variation. The radar data are compared with the Jacchia model, and a third harmonic is discussed. N.E.N.

N73-16428*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

INFLUENCE OF HAZE LAYERS UPON REMOTELY-SENSED SURFACE PROPERTIES

G. M. Jurica and W. L. Murray [1972] 8 p refs Presented at Conf. on Atmospheric Radiation, Fort Collins, Colo., 7-9 Aug. 1972

(Grant NGL-15-005-112)

(NASA-CR-130028; LARS-Print-060272) Avail: NTIS HC $3.00 CSCL 08M

The possibility that the presence of hazy layers contributes to anomalous effects in airplane remote sensing data on corn blight distribution is studied. Computations of scattering angles along flightlines are used to estimate reflected intensity variations as observed in bright and dark sides along flightline of the aircraft. G.G.

N73-16429# Naval Postgraduate School, Monterey, Calif.

HURRICANE HEAT POTENTIAL OF THE NORTH ATLANTIC AND NORTH PACIFIC OCEANS M.S. Thesis

Richard Francis Heffernan Sep. 1972 108 p refs

(AD-751590) Avail: NTIS CSCL 08/10

The thesis has two primary objectives, the first is to produce a Monthly Mean Hurricane Heat Potential Atlas based upon bathythermograph data for selected regions in the Tropical Atlantic and Pacific Oceans (this atlas also includes Mean Monthly Sea Surface Temperatures, Mean Monthly Depths of the 26C Isotherm, and Mean Monthly Layer Depths). The second objective is to compute changes in sea surface temperature and in the convective layer depth which would be associated with heat loss from the ocean in a severe tropical storm passage. Upwelling effects upon these quantities has been considered by other authors. GRA

N73-16430# Joint Publications Research Service, Arlington, Va.

DISTRIBUTION OF TOTAL OZONE CONTENT OF ATMOSPHERE ACCORDING TO SATELLITE OBSERVATIONS

V. M. Berezin and N. F. Yelanskiy 15 Jan. 1973 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Atmos. Okeana (Moscow), v. 8, no. 5, 1972 p 526-532

(JPRS-57976) Avail: NTIS HC $3.00

Data measurements of solar ultraviolet radiation scattered by the earth's atmosphere made by the Kosmos-121 earth satellite on 17 and 18 June 1966 were used to calculate the total ozone content of the atmosphere. Author

N73-16431# Lockheed Missiles and Space Co., Palo Alto, Calif.

LATITUDE-TIME VARIATIONS IN THE TOTAL NUMBER OF ELECTRONS AND ITS GRADIENTS IN HIGH-LATITUDE IONOSPHERE

G. K. Solodvnikov, V. M. Migunov, A. R. Iagovkin, and Iu. G. Ivanov [1972] 4 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 10, no. 5, 1972 p 796-799

Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Phase differences for signals from Cosmos 356 and Cosmos 378 were observed at two coherent frequencies during periods of high solar activity. The observations were carried out at two sites separated by 12 deg latitude, one being within the zone of active aurora borealis of the Northern Hemisphere. The signals from Cosmos 356 were observed during September 1970, and those from Cosmos 378 between 15 and 28 March 1971. These data were used to obtain the ionospheric electron density. A random diurnal distribution of electron density was observed over the polar cap. Latitude-time dependences of electron density, and dependences of the gradient in total number of electrons are presented in graphs. N.E.N.

N73-16432*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

CONTINUED DATA ANALYSIS FOR EXPERIMENT E-18 ON OGO-5 Final Report

K. K. Harris Nov. 1972 36 p refs

(Contract NAS5-23106)

(NASA-CR-130156) Avail: NTIS HC $4.00 CSCL 04A

The processing of all useful data acquired from the light ion mass spectrometer experiment on OGO-E is reported and results obtained from specific interpretations of the data are discussed. The work was confined primarily to processing the raw data to a form in which the specific light ion densities were obtained as a function of universal time. The data were then reproduced on magnetic tape as a function of both universal time and the important geomagnetic parameters, such as, L, B, magnetic latitude, magnetic longitude, geodetic latitude, geodetic longitude, altitude, etc. Author

N73-16433*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EFFECT OF AN ISOTOPIC NON-EQUILIBRIUM PLASMA ON ELECTRON TEMPERATURE MEASUREMENTS

Robert F. Benson and Walter R. Hoegy Dec. 1972 15 p refs Submitted for publication

(NASA-TM-X-66157; X-621-72-496) Avail: NTIS HC $3.00 CSCL 04A

Electron temperatures determined by electrostatic probe, diffuse resonance, and radar backscatter techniques in an isotropic two temperature plasma are presented. Plasma models corresponding to the addition of a minor component of energetic electrons, and models corresponding to a process that cools a fraction of the ionospheric electrons are considered. The diffuse resonance temperature is found to lie between the probe and radar backscatter temperatures. The isotropic models corresponding to the addition of energetic electrons cannot support the reported discrepancies between radio wave and probe electron temperature measurements. Temperature differences similar to the observed differences can be produced by models with a fraction of the electrons at a temperature cooler than that of the main component of electrons. Author

N73-16434*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

DEFINITION OF SPECTRALLY SEPARABLE CLASSES FOR SOIL SURVEY RESEARCH

J. E. Cipra, P. H. Swain, J. H. Gill, M. F. Baumgardner, and S. J. Kristof [1972] 7 p refs Presented at 8th Intern. Symp.

on Remote Sensing of Environment, Ann Arbor, Mich., 2-6 Oct. 1972
(Grant NGL-15-005-112)
(NASA-CR-130031; LARS-Print-100372) Avail: NTIS HC $3.00 CSCL 08M

A procedure is outlined for defining spectral classes such that the differences between classes can be quantified. It also facilitates determination of a number of classes such that the classes are spectrally discriminable. This is accomplished by partitioning the data into many classes and then combining similar spectral classes on the basis of appropriate criteria. Multispectral data were collected over a 12-mile flightline in White County, Indiana, in connection with the 1971 Corn Blight Watch Experiment. Data were collected in May by the University of Michigan airborne scanning spectrometer at an altitude of 5000 feet. Spectral maps resulting from the analysis were compared to existing soil surveys of the National Cooperative Soil Survey. The method should help determine the extent to which spectral properties of soil surfaces can be associated with morphologic and topographic differences of interest to soil surveyors engaged in operational soil mapping. Author

N73-16435*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AUTOMATIC CLASSIFICATION OF SOILS AND VEGETATION WITH ERTS-1 DATA
David A. Landgrebe 1972 10 p refs Presented at 23d Intern. Astronaut. Congr., Vienna, 14 Oct. 1972
(Contract NAS5-21773; Grant NGL-15-005-112)
(NASA-CR-130021; LARS-Print-101472) Avail: NTIS HC $3.00 CSCL 08M

Preliminary results of a test of a computerized analysis method using ERTS 1 data are presented. The method consisted of a four-spectral-band supervised, maximum likelihood, Gaussian classifier with training statistics derived through a combination of clustering and manual methods. The multivariate analysis method leads to the assignment of each resolution element of the data to one of a preselected set of discrete classes. The data frame was an area over the Texas-Oklahoma border including Lake Texoma. The study suggests that multispectral scanner data coupled with machine processing shows promise for earth surface cover surveys. Futhermore, the processing time is short and consequently the costs are low; a full frame can be analyzed completely within 48 hours. N.E.N.

N73-16436*# Pittsburgh Univ., Pa.
THE ALTITUDE OF THE SCATTERING LAYER NEAR THE MESOPAUSE OVER THE SUMMER POLES
T. M. Donahue and B. Guenther Dec. 1972 11 p ref
(Contract NAS5-11077; Grant NSF GA-27638)
(NASA-CR-130271; SRCC-182) Avail: NTIS HC $3.00 CSCL 04A

The variation in radiance and altitude with time and latitude is reported for the dense scattering layers observed over the summer poles by the OGO 6 airglow photometer. The average altitude was 84.3 km with a tendency for higher values on the night side than on the day side of the polar cap. The average radiance increased by a factor of 5 between day 163 and day 180, 1969, but decreased thereafter. Author

N73-16437*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
WATER QUALITY DETERMINATIONS IN THE VIRGIN ISLANDS FROM ERTS-A DATA
W. Egan Dec. 1972 26 p refs Presented at 8th Intern. Symp. on Remote Sensing of Environment, Ann Arbor, Mich., Oct. 1972 Sponsored by NASA
(NASA-CR-130008; RM-561J) Avail: NTIS HC $3.50 CSCL 08H

The harbor at Charlotte Amalie on St. Thomas, Virgin Islands, has a concentration of many factors affecting water quality: untreated sewage effluent, sediment from navigation and dredging operations, runoff from a garbage dump, and hot effluent from a desalination/power plant. Imagery from ERTS-A in association with aircraft imagery and ground truth permits the characterization of water quality in terms of absolute color values. This necessitates the establishment of photometric standards resolvable by the ERTS-A sensors in order that atmospheric effects, which generally vary on sequential overpasses, may be determined and subtracted. The over-all program is described together with typical numerical results. Author

N73-16438*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH LATITUDE PROTON PRECIPITATION AND LIGHT-ION DENSITY PROFILES DURING THE MAGNETIC STORM INITIAL PHASE
J. L. Burch Jan. 1973 25 p refs
(NASA-TM-X-66166; X-646-73-15) Avail: NTIS HC $3.25 CSCL 04A

Measurements of precipitating protons and light ion densities by experiments on OGO-4 indicate that widespread proton precipitation occurs in predawn hours during the magnetic storm initial phase from the latitude of the high-latitude ion trough, or plasmapause, up to Lambda > 75 deg. A softening of the proton spectrum is apparent as the plasmapause is approached. The separation of the low-latitude precipitation boundaries for 7.3 kev and 23.8 kev protons is approximately < 1 deg, compared with a 3.6 deg separation which has been computed using the formulas of Gendrin and Eather and Carovillano. Consideration of probable proton drift morphology leads to the conclusion that protons are injected in predawn hours, with widespread precipitation occurring in the region outside the plasmapause. Protons less energetic than approximately 7 kev drift eastward, while the more energetic protons drift westward, producing the observed dawn-dusk asymmetry for the lower-energy protons. Author

N73-16439# Lockheed Missiles and Space Co., Palo Alto, Calif.
MEASUREMENT OF ION CONCENTRATION IN EARTH'S IONOSPHERE AT 200 - 6000 km ALTITUDES
O. I. Babkov, E. A. Bashkin, S. I. Borisov, I. A. Dubov, V. D. Nikolaev, and E. G. Ulianov [1972] 6 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 10, no. 5, 1972 p 746-750
Avail: NTIS HC $3.00; National Translations Center; John Crerar Library, Chicago, Ill. 60616

Results of experiments to measure the ion concentration performed on the Kosmos-379, 398, and 434 satellites are discussed. The method of conducting the experiments is described and an estimate of the possible errors is given. The change in ion concentration with altitude is described. Stability of the ion concentration level at altitudes above 1500 km is noted. Information on the ion concentration distribution with altitude over the earth's surface is needed both to perfect the model of earth's ionosphere and to determine the domain of utilization of ion sensors in artificial earth satellite control systems. Author

N73-16440*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DATA ON OCEAN CONDITIONS FOR SPACE SHUTTLE BOOSTER RECOVERY CRITERIA
Preston E. Beck 1 Nov. 1972 112 p Revised
(NASA-TM-X-68631; KSC-TR-1180-Rev-1) Avail: NTIS HC $7.75 CSCL 08C

Empirical data are presented on the probable sea states that will be encountered by the booster recovery forces. Such data are required to establish the criteria for the recovery equipment and procedures Author

N73-16441*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROPOSED REVISION TO THE US STANDARD ATMOSPHERE 86 TO 200 km Report of Task Group 2 to COESA.
R. A. Minzner, C. A. Reber, K. S. W. Champion (AFRCL), O. K. Moe (McDonnell Douglas), A. O. Nier (Minn. Univ.), G. R. Swenson, and S. P. Zimmerman (AFRCL) Jan. 1973 44 p refs
(NASA-TM-X-66171; X-621-73-26) Avail: NTIS HC $4.25 CSCL 04A

The research activities are reported of the committee for the extension to the U.S. Standard Atmosphere in the region from 80 to 200 km. Discussions include: lower boundary condition, philosophy and constraints of the model, and atmospheric composition. F.O.S.

N73-16442*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MAGNETOSPHERIC FIELD MODEL INCORPORATING THE OGO 3 AND 5 MAGNETIC FIELD OBSERVATIONS
Masahisa Sugiura and D. J. Poros (Computer Science Corp., Silver Spring, Md.) Jan. 1973 27 p refs
(NASA-TM-X-66172; X-645-73-34) Avail: NTIS HC $3.50 CSCL 04A

A magnetospheric field model is presented in which the usually assumed toroidal ring current is replaced by a circular disk current of finite thickness that extends from the tail to geocentric distances less than 3 earth radii. The drastic departure of this model from the concept of the conventional ring current lies in the fact that the current is continuous from the tail to the inner magnetosphere. This conceptual change was required to account for the recent results of analysis of the OGO 3 and 5 magnetic field observations. In the present model the cross-tail current flows along circular arcs concentric with the earth and completes circuit via surface currents on the magnetopause. Apart from these return currents in the tail magnetopause, Mead's model is used for the field from the magnetopause current. The difference scalar field, delta B, defined as the difference between the scalar field calculated from the present model and the magnitude of the dipole field is found to be in gross agreement with the observed delta B. An updated version of the delta B contours from the OGO 3 and 5 observations, which is used for the comparison, is presented. Author

N73-16443*# California Univ., Riverside. Dept. of Geography.
THE DEFORMATION CHARACTERISTICS OF HILL SLOPES AND CHANNELWAYS IN TWO DIFFERENT ENVIRONMENTS AS DEPICTED BY REMOTE SENSOR RETURNS
Donald H. Poole (East Tennessee State Univ., Johnson City) [1972] 54 p refs
(Grant NGL-05-003-404; Contracts F19628-69-C-0116; N00014-69-A-0200-5001; NR Proj. 387-047; Proj. Themis)
(NASA-CR-130379; AD-748642; TR-T-72-1) Avail: NTIS HC $4.75 CSCL 08/6

Two forms of rapid mass wastage, mudflow and debris slide, are considered. Both forms of movement are studied in their environment of occurrence using a remote sensing approach. The two environments included Wildwood Canyon watershed in California and Davis Creek watershed in Virginia. Data sources include standard black and white aerial photography, Aero Ektachrome, and Aero Ektachrome Infrared (CIR) photography. A comparison of mass wastage phenomena in the two areas reveals many similarities in form, and between the physical character of the drainage ways. In Wildwood Canyon maximum deformation was limited to several small tributaries and the main channel. Both channel and widespread slope distruction occur throughout the Davis Creek drainage Basin. Results from the investigation indicate that considerable information related to mass wastage phenomena can be extracted from aerial photographs. Information interpreted from photographic images came from pattern, color contrasts and geometric form of mass wastage scars. Author

N73-16444# National Ocean Survey, Rockville, Md.
PACIFIC SEAMAP 1961 - 1970: DATA FOR AREAS 16524-10 AND 17524-10. LONGITUDE 165 DEG W TO 180 DEG W, LATITUDE 24 DEG N TO 30 DEG N: BATHYMETRY, MAGNETICS, AND GRAVITY
E. F. Chiburis (Conn. Univ.), J. J. Dowling (Conn. Univ.), and P. Dehlineger (Conn. Univ.) Jul. 1972 254 p refs
(NOAA-TR-NOS-50) Avail: SOD $5.75

Processed bathymetry, magnetic, and gravity data, collected between 1961 and 1970 in the North Pacific area bounded by longitudes 165 W and 175 W and latitudes 24 N and 30 N (SEAMAP Area 16524-10), and some data collected west of 175 W in SEAMAP Area 17524-10, are listed in computer printout format. More than 19,000 evaluated data points from Project Pacific SEAMAP surveys are included. The listing identifies the vessel, cruise, position and time of each bathymetric measurement corrected depth, correction applied for sound velocity variation, total magnetic field intensity, magnetic anomaly, observed gravity, free-air gravity anomaly, and gravity meter used. Author

N73-16445# National Ocean Survey, Rockville, Md.
PACIFIC SEAMAP 1961 - 1970: DATA FOR AREAS 16530-10 AND 17530-10. LONGITUDE 165 DEG W TO 180 DEG W, LATITUDE 30 DEG N TO 36 DEG N: BATHYMETRY, MAGNETICS, AND GRAVITY
E. F. Chiburis (Conn. Univ.), J. J. Dowling (Conn. Univ.), P. Dehlinger (Conn. Univ.), and M. J. Yellin Jul. 1972 163 p refs
(NOAA-TR-NOS-49) Avail: SOD $4.75

Processed bathymetry, magnetic, and gravity data, collected between 1961 and 1970 in the North Pacific area bounded by longitudes 165 W and 175 W and latitudes 30 N and 36 N (SEAMAP Area 16530-10), and some data collected west of 175 W in SEAMAP Area 17530-10, are listed in computer printout format. More than 11,000 evaluated data points from Project Pacific SEAMAP surveys are included. The listing identifies the vessel, cruise, position and time of each bathymetric measurement, corrected depth, correction applied for sound velocity variation, total magnetic field intensity, magnetic anomaly, observed gravity, free-air gravity anomaly, and gravity meter used. Author

N73-16446*# Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENTS OF THERMAL CONDUCTIVITY IN THE SUBSOIL
R. Koitzsch Washington NASA Feb. 1973 14 p refs Transl. into ENGLISH from Z. Meteorol. (Berlin), v. 19, no. 11/12, 1967 p 375-380
(Contract NASw-2481)
(NASA-TT-F-14664) Avail: NTIS HC $3.00 CSCL 08M

Thermal conductivity measurements were made by means of a nonstationary method in a boulder clay from 1 to 2 m depth, as well as on soil core samples in the laboratory. At soil moisture contents from 10% by weight to full water saturation, there is the well-known effect of soil moisture on thermal conductivity and a pronounced effect of soil density. This effect is discussed in connection with references found in the literature. Author

N73-16447# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
TECHNICAL PROCEDURES FOR CHARACTERIZING THE TERRESTRIAL GAMMA RADIATION ENVIRONMENT BY AERIAL SURVEYS
Z. G. Burson, P. K. Boyns, and A. E. Fritzsche 1972 44 p refs Presented at 2d Conf. on Nat. Radiation Environment, Houston, Tex., 7 Aug. 1972 Sponsored by AEC
(EGG-1183-1559; Conf-1183-1559) Avail: NTIS

Technical procedures and considerations for interpreting the results of the surveys of the Aerial Radiological Measuring System (ARMS) and converting airborne nuclear counting data to terrestrial, surface exposure rates, and isotopic concentrations are discussed. Some of the important considerations include: background delineations, ground roughness and source distribution effects on the air-to-ground conversions, the treatment of the data to obtain ground level information, validating the results by correlating with ground level experimental data, and the use of spectral information for isotope identification. Author (NSA)

N73-16448# Sandia Labs., Albuquerque, N.Mex.
ROCKET-BORNE AURORAL OPTICAL MEASUREMENTS
G. C. Tisone, R. O. Woods, and J. M. Hoffman Aug. 1972 62 p refs Sponsored by AEC
(SC-RR-72-0543) Avail: NTIS

The optical results from rocket-borne auroral experiments are presented. Measurement of the H beta intensities indicate that there was no appreciable precipitation of protons for the flight on March 19, 1971, while data for the flight on March 27, 1971, indicate that there may have been localized precipitation of protons. Data are presented for the overhead brightness and volume emission rates for N2(3371 A), N2(+)(3914 A), and O(5577 A). Comparisons between observed volume emission rate for 3914 A and a calculated volume emission rate using two different forms of the differential electron spectrum were made. The O(5577 A) data were compared to various proposed excitation mechanisms. Comparison between the experimental data and excitation due to dissociative recombination is also discussed. An estimate of the magnitude of the cross section

for excitation due to dissociative excitation was made.
Author (NSA)

N73-16449# Utah Univ., Salt Lake City. Dept. of Meteorology.
RESEARCH ON ATMOSPHERIC DIFFUSION AND TURBULENCE Final Report
S. K. Kao Jul. 1972 142 p refs
(Contract AT(11-1)-1585)
(COO-1585-22) Avail: NTIS
The spectral characteristics of large scale turbulence and diffusion of pollutants in the atmosphere are outlined. Investigations were made from an analytical and numerical approach using observed wind data collected over the northern and southern hemispheres. Author

N73-16450# Atomic Energy Commission, Washington, D.C.
ENVIRONMENTAL AND ECOLOGICAL FORUM, 1970 - 1971
Jun. 1972 194 p refs Sponsored in parts by Baltimore-Washington Chapter of the Health Physics Society, Washington Section of the Am. Nucl. Society, Mid-Atlantic Chapter of the Am. Assoc. of Physicists in Medicine, Montgomery County Public School Adult Education Program, and AEC
(TID-25857; LC-72-600120) Avail: NTIS
Conference papers given on the significant environmental, social, economic, and ecological effects of nuclear electric power generation are presented. The conference was organized as a public service to foster community understanding of environmental problems that increasingly tax society's capabilities for remedial action. Knowledgeable speakers discussed the various ways in which the increasing development and use of technology may affect man's well-being, and ways of developing informed, independent judgments on matters which ultimately will have an impact on people and their families. Author

N73-16451# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
ON THE GENERAL RELATIVITY SHIFT EFFECT OF GRAVITATIONAL VIBRATION FREQUENCY IN THE EARTH FIELD OF SCHWARZSCHILD
M. F. Shirokov and A. V. Ivashenko 1972 12 p refs In RUSSIAN; ENGLISH summary
(ITF-72-43-P) Avail: AEC Depository Libraries
A new effect, due to Shirokov, of the difference in frequencies of the gravitational vibrations of frequencies in the earth satellite in a plane perpendicular to the orbit and in an orbital plane is considered. A theory of this effect is given.
Author (NSA)

N73-16452# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
ON THE MODELING OF GRAVITATIONAL FIELDS
A. Z. Petrov 1971 16 p refs In RUSSIAN; ENGLISH summary
(ITF-71-130-P) Avail: AEC Depository Libraries
The modeling of gravitational field is discussed within the framework of Einstein's theory. The modeling is defined as a mapping in which the geodesic lines (paths of test bodies) of the original transform into a family of the curves given by the equations of the test-body motion in a model. Different ways of modeling are indicated: complete, selective, approximate-selective ones. The theory is applied for the solar gravitational field.
Author (NSA)

N73-16453# Ernst-Mach-Inst., Freiburg (West Germany).
REGULAR REFLECTION OF SHOCK WAVES
Werner Heilig Dec. 1971 21 p refs In GERMAN; ENGLISH summary
(Rept-9/71) Avail: NTIS HC $3.25
A theory for regular or oblique reflection of shock waves is formulated and discussed. The solution of the equation system, which gives data necessary for the study of unsteady shock wave phenomena, is detailed. The adiabatic exponent is included in the equation as a parameter to apply equations to ideal gases other than air. In addition, boundary cases of regular reflection, which correspond to the transition to Mach reflection, are considered. ESRO

N73-16454# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
RESULTS FROM BARIUM CLOUD RELEASES IN THE IONOSPHERE AND MAGNETOSPHERE
Gerhard Haerendel Jul. 1972 31 p refs Presented at the 15th Plenary COSPAR Meeting, Madrid, May 1972
(MPI-PAE/Extraterr-67) Avail: NTIS HC $3.75
A survey is given of recent progress in barium cloud releases using the shaped charge technique in the ionosphere and magnetosphere. Shaped charges allow barium plasma injection from an altitude of about 500 km up to and above 10,000 km along magnetic lines of force. The suitability of such experiments between conjugate points and vertically upward from stations in the auroral zone has been demonstrated for studying the geometry of the magnetic field with great accuracy, the frozen-in condition of the magnetospheric plasma, and ion-neutral collision frequencies below 500 km. Conventional barium cloud releases in the polar ionosphere have helped to clarify the polar convection pattern and have contributed to the evidence for the existence of magnetic field aligned currents. Author (ESRO)

N73-16455# Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
SOME SEISMIC MEASUREMENTS ON THE VIRGINIA COASTAL PLAIN
John K. Costain and Edwin S. Robinson Sep. 1972 79 p refs Sponsored in part by Dept. of Interior
(PB-212604; VPI-WRRC-Bull-56; OWRR-A-034-VA(3)) Avail: NTIS HC $3.00 CSCL 08K
Seismic reflection and refraction surveys were made on the eastern coastal plain of the United States near Franklin and Boykins, Virginia, to investigate the thickness of the coastal plain sediments. Seismic reflection data indicated a total thickness of 990 feet near Franklin, and 575 feet near Boykins. Seismic reflections from the base of the unconsolidated sedimentary section were well recorded at both locations. Computer analysis of the reflection data revealed additional reflections from within the sedimentary section which were not clearly evident on the field records. Author (GRA)

N73-16456# Woods Hole Oceanographic Institution, Mass.
DIGITAL SIGNAL PROCESSING OF OCEANIC SEISMIC PROFILER DATA, 1971 Progress Report
S. T. Knott, Hartley Hoskins, A. B. Baggeroer, and E. T. Bunce Sep. 1972 34 p refs
(Grant NSF GA-27516)
(PB-212155; WHOI-72-69) Avail: NTIS HC $3.00 CSCL 08G
Initial phases of a program to apply digital signal processing to oceanic seismic reflection profiler data are described and the first year results are documented. Objectives have been: (1) to improve the detection of deeply buried reflectors in thickly sedimented areas (continental margins); and (2) reduce the interference from multiple reflections for improved detection and resolution of reflectors in shallow water areas (continental slopes and shelves). Emphasis has been on the following procedures: (1) the fundamental of digitizing with fidelity, good dynamic range, and synchronization with the original data time base; (2) signal to noise improvement by time domain filtering methods, principally signal averaging or stacking along specified geological interface trends; (3) reduction of the interference of reflections that repeatedly traverse the water column and overprint reflections from deep interfaces; and (4) examination of the reflected energy budget to evaluate the potential effectiveness of the stacking and of the multiple reflection interference reduction. Author

N73-16457# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
ANALYSES OF STRONG MOTION EARTHQUAKE ACCELEROGRAMS. VOLUME 3: RESPONSE SPECTRA. PART A: ACCELEROGRAMS IIA001 THROUGH IIA020
A. G. Brady, D. E. Hudson, and Mihailo D. Trifunac Aug. 1972 278 p refs
(Grant NSF GK-28098X)
(PB-212602; EERL-72-80-Vol-3-Pt-A) Avail: NTIS CSCL 08K
The report is the first volume of a series presenting earthquake response spectrum curves calculated from corrected ground accelerograms. For each earthquake accelerogram, two spectrum plots are given relative velocity response versus period on a linear scale, and a tripartite log-log plot giving relative displace-

ment, pseudo-velocity, and pseudo-acceleration spectra. The Fourier spectrum plot is also shown on the linear plot. Digital printouts of ordinates of the plotted curves are tabulated for each earthquake. The earthquakes in part A match the uncorrected accelerogram data of volume 1 and the corrected accelerogram data of volume 2. Author (GRA)

N73-16458# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
ANALYSIS OF STRONG MOTION EARTHQUAKE ACCELEROGRAMS. VOLUME 4: FOURIER AMPLITUDE SPECTRA. PART A: ACCELEROGRAMS IIA001 THROUGH IIA020
Firdaus E. Udwadia, A. Vijayaraghavan, D. E. Hudson, A. Gerald Brady, and Mihailo D. Trifunac Aug. 1972 170 p refs
(Grant NSF GK-28098)
(PB-212603; EERL-72-100-Vol-4-Pt-A) Avail: NTIS CSCL 08K

The report is the first volume of a series presenting Fourier amplitude spectra for earthquake ground motions and for structural response accelerations. An introduction summarizes Fourier spectrum techniques in earthquake engineering as a background to the use of the data. For each earthquake accelerogram, two spectrum versus given - a Fourier amplitude spectrum versus frequency on a linear scale, and a log-spectrum, log-frequency plot. In the series, Fourier amplitude spectra will be given for all corrected accelerograms, including building response measurements. Author (GRA)

N73-16459# Naval Electronics Lab. Center, San Diego, Calif.
SOLAR X-RAY SPECTRUM DEFINITION AND THE PREDICTION OF IONOSPHERIC RADIO WAVE PROPAGATION Research Report, May 1971 - Sep. 1972
M. P. Bleiweiss 1 Sep. 1972 65 p refs
(AD-751575; NELC-TR-1840) Avail: NTIS CSCL 04/1

The effects of deviations in determination of solar X-ray spectra on predictions of HF and VLF radio wave propagation parameters were determined for various levels of solar activity. For analytical purposes, the form that the uncertainties in the X-ray measurements assumed was that of uncertainties in the temperature of the solar emitting region as opposed to uncertainties in emission measure. The temperatures used to represent the various levels of solar activity were 5, 10, 15, and 20 x 10 to the 6th power. The uncertainties in temperature T were represented by T plus or minus percent change X T where the percent changes were 0%, plus or minus 10%, plus or minus 25%, and plus or minus 50%. It is determined that for predictions of HF absorption, X-ray spectral definition is required to be better than plus or minus 25% for low temperatures and plus or minus 50% for high temperatures. VLF prediction requires the spectra to be known to at least plus or minus 50% and probably plus or minus 25%. GRA

N73-16460# Naval Undersea Research and Development Center, San Diego, Calif.
HORIZONTAL FORCES DUE TO WAVES ACTING ON LARGE VERTICAL CYLINDERS IN DEEP WATER Technical Report, Mar. - Jul. 1970
E. R. Johnson Oct. 1972 22 p refs
(AD-751574; NUC-TP-322) Avail: NTIS CSCL 08/3

The special case of horizontal wave forces on large vertical cylinders in deep water is considered. The typical application for such a case is the calculation of horizontal forces on column-stabilized floating ocean platforms. Existing literature discussing horizontal wave forces on cylinders does not generally agree on how to predict these forces. Since for large-diameter cylinders in deep water the maximum force is completely inertial, the problem of deriving a solution is considerably simplified. In this study, an expression for the maximum horizontal wave force on large-diameter circular cylinders mounted vertically in deep water has been analytically derived. Experimental model studies were also conducted and the resulting measured forces are compared to predicted forces. An example of how to predict horizontal wave forces using the methods of the report is given. Author (GRA)

N73-16461# Stanford Research Inst., Menlo Park, Calif.
OPTICAL, MAGNETIC, AND RADIO MEASUREMENTS IN SUPPORT OF THE OOSIK EXPERIMENT Final Report, 1 Feb. - 31 Aug. 1972
George B. Carpenter Aug. 1972 57 p refs
(Contract N00014-72-C-0394; ARPA Order 2141; SRI Proj. 1841)
(AD-751567; SRI-1841-FR) Avail: NTIS CSCL 04/1

At 0659 GMT March 7, 1972 a shaped barium charge was released high above central Alaska by the Los Alamos Scientific Laboratory and the University of Alaska. In support of the experiment, known as OOSIK, the Stanford Research Institute operated two existing radar facilities in Alaska. In addition, a low-frequency receiving site was established and operated near the point at which the field line through the barium release intercepted the ground. The most striking feature of the data recorded during the OOSIK experiment is the occurrence of a magnetic substorm 17 minutes after the barium injection. Considerable visible and radar aurora accompanied the substorm. A number of factors strongly indicate that the substorm was of natural origin. Among these factors is a comparison of the plasma density required to initiate a magnetospheric instability and the density achieved by the OOSIK injection. Population of multiple field lines by OOSIK apparently reduced the density in any one flux tube far below that required to initiate an instability at the local time of injection. If the problem of multiple population can be avoided during an early-morning launch when magnetospheric conditions are favorable, it seems likely that an instability can be triggered by a rocket-launched shaped barium charge. Author (GRA)

N73-16462# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
NUMERICAL SIMULATION OF WIND, TEMPERATURE, SHEER STRESS AND TURBULENT ENERGY OVER NON-HOMOGENEOUS TERRAIN
Chin-hua Huang and E. C. Nickerson Mar. 1972 270 p refs
(Contract N00014-68-A-0493-0001; NR Proj. 062-414; Proj. Themis)
(AD-751589; CER71-72CH-ECN23; THEMIS-CER-TR-12) Avail: NTIS CSCL 04/1

Airflow in the atmospheric surface layer over inhomogeneous surfaces with discontinuities in surface roughness and temperature is investigated by numerical techniques. A computational scheme is developed for solving the steady state two-dimensional boundary layer equations. Several theorems of convergence are proved. A successful numerical test, which has been compared to the exact solution, is achieved. Some iterative schemes, which have already enjoyed considerable success without theoretical support are here shown to be convergent. The variations in pressure and buoyancy force associated with changes in surface roughness have been neglected by previous investigators whose work is included in the present study. The numerical results of velocity and shear stress are compared with wind tunnel and field data. The roughness and temperature discontinuities are shown to have an effect on the upstream as well as the downstream flow conditions. Author (GRA)

N73-16463# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SECULAR MAGNETIC VARIATION AND THE INNER ZONE Report for Oct. 1971 - May 1972
Henry H. Hilton 12 Oct. 1972 15 p refs
(Contract F04701-72-C-0073)
(AD-751284; TR-0073(3260-20)-6; SAMSO-TR-72-253) Avail: NTIS CSCL 04/1

The secular variation of the earth's magnetic field has important consequences concerning the steady-state inner zone of energetic protons. One consequence is the decrease in minimum altitude for particles having a constant flux invariant Phi and a constant invariant parameter Kappa. This affects the rate at which particles lose energy to free and bound atmospheric electrons. Another consequence is the increase in the magnitude of the mirror-point field, resulting in a slow increase in a particle's energy. It is found that for equatorially mirroring particles at a nominal L = 1.10, conservation of Kappa and Phi causes the minimum mirror altitude to decrease at a rate of 6 km/year using the IGRF (1965.0) model for the earth's magnetic field, and at a rate of 11 km/year using the POGO (8/69) model. Author (GRA)

N73-16464# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A DEVICE TO MEASURE MASS DENSITY AND ATOMIC OXYGEN CONCENTRATION IN THE LOWER THERMOSPHERE: CALIBRATION AND SIGNAL ESTIMATES Technical Report, Sep. 1970 - Mar. 1972
Virginia L. Carter and Arthur B. Prag 7 Nov. 1972 24 p ref
(Contract F04701-72-C-0073)
(AD-751468; TR-0073(9260-01)-5; SAMSO-TR-72-245) Avail: NTIS CSCL 04/1

A device has been developed that can simultaneously measure the total mass density rho and the number density of atomic oxygen n(O) in a flowing gas stream. It consists of a pair of matched thermopiles, one of which is coated with silver to catalize the recombination of atomic oxygen. The device has been calibrated in the laboratory. Signal levels are estimated for both rocket-borne and satellite-borne configurations and are shown to be adequate to measure rho and n(O) in the lower thermosphere. Author (GRA)

N73-16465# Naval Research Lab., Washington, D.C. Atmospheric Physics Branch.
CONCURRENT MEASUREMENTS OF WATER VAPOR AND OZONE OVER WASHINGTON, D. C., DURING 1969 AND 1970 Final Report
H. J. Mastenbrook and D. R. Purdy 16 Oct. 1972 244 p refs
(AD-751535; NRL-7489) Avail: NTIS CSCL 04/1

Concurrent measurements of the vertical distribution of water vapor and ozone in the atmosphere have been obtained at approximately one-month intervals at a site near Washington, D.C. Data for 19 soundings during the period 1969 and 1970 are presented in tables and graphs. Author (GRA)

N73-16466# Institute for Defense Analyses, Arlington, Va. Jason Div.
STRATOSPHERIC NITRIC OXIDE PRODUCTION FROM PAST NUCLEAR EXPLOSIONS AND ITS RELEVANCE TO PROJECTED SST POLLUTION
H. M. Foley and M. A. Ruderman Aug. 1972 34 p refs
(AD-751295; P-894; IDA/HQ-72-14452) Avail: NTIS CSCL 04/1

It is shown that during certain years of intense nuclear testing, high-yield nuclear explosions seem to have injected into the stratosphere a few times 10 to the 34th power nitric oxide molecules. This is very similar to upper estimates for NO generation from 500 SSTs flying for a year. Large catalytic ozone reduction from such NO injection was not observed in worldwide or local total ozone measurements. Author (GRA)

N73-16467# Texas Instruments, Inc., Dallas. Services Group.
EXTENDED ARRAY EVALUATION PROGRAM Quarterly Report, 1 Jul. - 30 Sep. 1972
Terence W. Harley 15 Oct. 1972 18 p
(Contract F33657-72-C-0725; ARPA Order 1714)
(AD-751523; QR-2) Avail: NTIS CSCL 17/10

The second quarterly report summarizes progress in the following areas: ALPA evaluation; NORSAR long period evaluation; NORSAR short period evaluation; VLPE evaluation; and Network evaluation. GRA

N73-16468# Pittsburgh Univ., Pa. Atmospheric Sciences Inst.
ATOMIC AND MOLECULAR PROCESSES IN ATMOSPHERIC ENVIRONMENTS Technical Progress Summary Report
M. A. Biondi 23 Oct. 1972 41 p refs
(Grant DA-31-124-ARO(D)-440; ARPA Order 826)
(AD-751766; AROD-6563-53-P) Avail: NTIS CSCL 04/1

Research projects at the Pittsburgh Atmospheric Sciences Institute are identified by title, senior investigator(s) in charge of the work, and task designation(s). The summary presents only brief research descriptions of the topics. GRA

N73-16469# Naval Postgraduate School, Monterey, Calif.
NUMERICAL SIMULATION OF THE GENERATION OF GRAVITY WAVES IN A FRONTAL ZONE M.S. Thesis
Robert Ole Given Sep. 1972 48 p refs
(AD-751638) Avail: NTIS CSCL 04/1

The generation of gravity waves in a frontal zone is investigated with a numerical model. The solutions show that gravity waves can be generated in a frontal zone by the application of heating function which varies sinusoidaly with time, and that such waves propagate both ahead of and behind the frontal zone. The amplitudes of the waves are directly proportional to the magnitude of the forcing function and to the period of sinusoidal oscillation. Even with large heating rates, no hydraulic jumps are formed. Author (GRA)

N73-16470# Naval Postgraduate School, Monterey, Calif.
A NUMERICAL INVESTIGATION OF THE LONG-TERM TRANSIENT BEHAVIOR IN A COUPLED ATMOSPHERIC-OCEAN MODEL Ph.D. Thesis
Wayne Roger Lambertson Sep. 1972 222 p refs
(AD-751637) Avail: NTIS CSCL 04/2

A two-level, quasi-geostrophic atmospheric model on a midlatitude Beta-plane with a single wave in the X direction was coupled with a three level primitive equation ocean model through the exchange of sensible heat and momentum to investigate the effect of the ocean circulation on transients in the atmospheric circulation and vice versa. A long-term (79 years) simulation of the atmosphere-ocean system was carried out. The experiment was conducted in three phases that consisted of integrating the combined, the ocean-only and the atmosphere-only model equations. The combined model produced realistic patterns of both atmospheric and oceanic circulations. Energy studies of the atmosphere were completed with the results comparing favorably with the existing knowledge of the energy balance in the real atmosphere. Author (GRA)

N73-16471# Naval Postgraduate School, Monterey, Calif.
THE WAVELENGTH DEPENDENCE OF THE MODULATION TRANSFER FUNCTION OF THE ATMOSPHERE M.S. Thesis
Jere Gene Mackin Jun. 1972 33 p refs
(AD-751641) Avail: NTIS CSCL 04/1

An apparatus was designed and constructed to measure the modulation transfer function of the atmospheric medium as a function of wavelength of light. The modulation transfer function (MTF) in this case was considered to be the ratio of the modulation of an optical target at a fixed range to the modulation at a range short enough so that atmospheric attenuation was negligible. Modulation measurements were made using a telescope which focused the image of the target on a slit. The image was mechanically scanned across the slit by a rotating mirror, and the intensity at the slit was measured by a photodetector. The preliminary results indicated a linear decrease in modulation of 0.1 per 1000A. Author (GRA)

N73-16472# Dikewood Corp., Albuquerque, N.Mex.
POLAR CAP BIBLIOGRAPHY WITH ABSTRACTS. 4: THE STRUCTURE AND GENERAL GEOPHYSICAL CHARACTERISTICS OF THE POLAR CAP UPPER ATMOSPHERE
June G. Brenton, comp. 15 Jun. 1972 79 p
(Contract F19628-70-C-0212; AF Proj. 7661)
(AD-751336; DC-TR-1212-5; AFCRL-72-0480; SR-2-Vol-4)
Avail: NTIS CSCL 04/1

The references mentioned in the report are generally to articles published between 1960 and the end of 1971. They are grouped under nine subject headings that describe the polar cap upper atmosphere and the instrumentation and measurement systems used in the studies. The subject headings are: Temperatures, Densities, Winds, Neutral composition, Charged particle composition, Reaction mechanisms, Reaction rates, General geophysical characteristics, and Instrumentation and measurement systems for study of the polar cap atmosphere. Author (GRA)

N73-16473# Dikewood Corp., Albuquerque, N.Mex.
POLAR CAP BIBLIOGRAPHY WITH ABSTRACTS. 3: ENERGY INPUTS AND OUTPUTS FOR THE POLAR CAP UPPER ATMOSPHERE
June G. Brenton, comp. 30 May 1972 176 p refs
(Contract F19628-70-C-0212; AF Proj. 7661)
(AD-751335; DC-TR-1212-4; AFCRL-72-0459; SR-2-Vol-3)
Avail: NTIS CSCL 04/1

The report contains abstracts on selected topics in the literature on upper atmospheric phenomena in the inner regions of the polar caps. Although a few references on cosmic rays,

auroras, airglow, and noctilucent clouds go back to the 1930's or 1950's, the references are mostly from the last decade of 1961 through 1971. They are divided into 13 groups that cover the flux and energy spectrum of precipitated particles, cosmic rays, the optical emissions of aurora, airglow, and noctilucent clouds, atmospheric heating, photoionization, ionization by particle bombardment, and the instrumentation and measurement systems used to study the inputs and outputs of energy in the polar cap upper atmosphere. Author (GRA)

N73-16474# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

QUANTITATIVE DESCRIPTIONS OF THE INTERACTION BETWEEN THE OCEAN AND ATMOSPHERE FOR THE ATLANTIC REGION

K. V. Voitova, D. L. Laikhtman, N. A. Romanova, and V. G. Snopkov 22 Sep. 1972 19 p refs Transl. into ENGLISH from Okeanologiya (USSR), v. 11, no. 4, 1971 p 598-605
(AD-751415; FTD-MT-24-943-72) Avail: NTIS CSCL 04/2

The article describes the small-scale interaction between the ocean and atmosphere - heat flow, vapor, momentum in the layer near the water surface - found by two methods from standard meteorological observations conducted on scientific research vessels. GRA

N73-16475# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FORECAST OF THE GEOPOTENTIAL FOR A LARGE TERRITORY BY A BAROTROPIC DIVERGENT

Z. I. Tskvitinidze 15 Sep. 1972 14 p refs Transl. into ENGLISH from Tr. Gidromet Nauch.-Issled. Tsentr (USSR), no. 48, 1970 p 52-57
(AD-751422; FTD-HT-23-883-72) Avail: NTIS CSCL 04/2

A scheme for short range forecasting of the geopotential and wind for a large territory is considered, based on the solution of a barotropic variation of a full system of equations of hydrodynamics. The forecasts according to this numerical scheme were calculated for a period of up to 3 days. Evaluations of the AT(500) forecasting maps are given, as are also examples of forecasts for 24, 48, and 72 hours. Author (GRA)

N73-16476# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

HAZE FREE AND CLOUD FREE LINES OF SIGHT THROUGH THE ATMOSPHERE

Iver A. Lund 13 Sep. 1972 22 p refs
(AF Proj. 8624)
(AD-751264; AFCRL-72-0540; AFCRL-ERP-413) Avail: NTIS CSCL 04/1

Clear and cloud-free line-of-sight probabilities have been derived from analysis of: (1) Whole-sky photographs, (2) visual sky cover observations, (3) jointly observed sky cover and sunshine, (4) satellite observations, and (5) in-flight observations. The most accurate probabilities of cloud-free lines-of-sight through the entire atmosphere can be obtained from a model derived from several thousand whole-sky photographs and visual sky cover observations. The most accurate probabilities of both cloud-free and haze-free conditions through the entire atmosphere, or protions of the atmosphere, can be obtained from the in-flight observations. Author (GRA)

N73-16477# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

MODELING THE BOTTOMSIDE IONOSPHERIC ELECTRON DENSITY PROFILE

Robert E. Cookingham 5 Jun. 1972 68 p refs
(ILIR Proj. 00-01)
(AD-751267; AFCRL-72-0340; AFCRL-ERP-401) Avail: NTIS CSCL 04/1

A model describing the mid-latitude bottomside electron density profile is presented. The only geophysical input parameters required for the model are critical frequency, M-factor, planetary index (Ap), and 2800 MHz solar radio flux. An empirically-determined formula for calculating H(m)F2 is derived and used in the model. This formula is a function of the M-factor, local time, day number and magnetic activity. The results obtained by comparing predicted profiles to observed electron density profiles are presented in the form of mean percentage errors as a function of height and local time. The New Model is compared to a model currently in operational use and is shown to be a 10 to 20 percent improvement. Author (GRA)

N73-16478# Ballistic Research Labs., Aberdeen Proving Ground, Md.

ASSOCIATION, SWITCHING, AND REARRANGEMENT FOR POSITIVELY CHARGED CLUSTER IONS IN THE UPPER ATMOSPHERE. 2: APPLICATION AT 80 km

Joseph M. Heimer, John A. Vanderhoff, Lawrence J. Puckett, George E. Keller, and Franklin E. Niles Aug. 1972 27 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-751140; BRL-1605) Avail: NTIS CSCL 04/1

A path between NO(+) and H(+)(H2O)2 is proposed that may be fast enough to satisfy ionospheric requirements at 80 km. The path consists of six steps. The cluster ion NO(+)(N2) is formed. N2 is replaced by CO2, CO2 is replaced by H2O; NO(+)(H2O) is presumed to undergo an ion-atom interchange reaction with either OH or HO2 or both to form H(+)(H2O); The cluster ion H(+)(H2O)(N2) is formed; and N2 is replaced by H2O to form H(+)(H2O)2. Author (GRA)

N73-16479# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

VARIATIONS IN STRATOSPHERIC CIRCULATION AND OZONE DURING SELECTED PERIODS

J. S. Randhawa Aug. 1972 29 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-751211; ECOM-5460) Avail: NTIS CSCL 04/1

An experimental study was undertaken to investigate the atmospheric circulation and temperature effects on stratospheric ozone during the winter storm period. Rocket-borne ozone-temperature sondes were used to monitor ozone, temperature and wind field on three different days. The results obtained show that at one time during this study, meridional and zonal flow did undergo a change, and on that occasion, the ozone structure changed to a three-peak distribution. Possible contribution from the vertical motions in the atmosphere is considered.
Author (GRA)

N73-16480# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Ionospheric Physics Lab.

AIRBORNE DETERMINATION OF ARCTIC IONOSPHERE CROSS SECTIONS Environmental Research Papers

G. J. Gassmann, R. W. Gowell, C. P. Pike, and R. A. Wagner 5 Sep. 1972 33 p refs
(AF Proj. 5631)
(AD-751235; AFCRL-72-0525; AFCRL-ERP-4) Avail: NTIS CSCL 04/1

From 3 to 20 June 1972 the airborne ionospheric laboratory was stationed in RAF Mildenhall, England, for the purpose of obtaining realistic ionization cross-sections suitable for assessing HF propagation conditions in the Arctic. A number of quasi-instantaneous cross-sections for various hours during local night of five different days were produced, however limited to low magnetic activity, except for one PCA event, and limited to the area north of England. The results provide a three dimensional representation of the ionosphere along a 7 degree wide azimuth range. Author (GRA)

N73-16481# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE FORMATION OF SEISMIC WAVES IN THE GROUND NEAR THE SURFACE DURING AN EXPLOSION

V. B. Lebedev, A. A. Provalov, A. N. Romashov, and V. M. Chubarov 11 Aug. 1972 31 p refs Transl. into ENGLISH from Vzryvnoe Delo (USSR), no. 64, 1968 p 93-109
(AD-751070; FTD-HT-23-549-72) Avail: NTIS CSCL 19/4

Laboratory experiments have been made on movements of a medium near the charge during explosions at ground surface. Movements were measured at the edge of the crater and immediately next to this on the surface and within the mass. All experimental results confirm the opinion that it is impossible to represent an explosion near the free surface as a spherical symmetrical center of expansion. Particle trajectories were measured in modeling clay, pressed between two thick steel plates, one of which had a plastic window. This placing of the charge led to almost complete release of energy toward the

clay. Trajectories for individual points at the edge of the crater and beyond are shown for a charge of 0.4 g and charge depth of 40mm. Author (GRA)

N73-16482# Stanford Univ., Calif. Inst. for Plasma Research.
NONLINEAR INTERACTION OF LONG, UNMODULATED WHISTLER-MODE SIGNALS AND GYRORESONANT Interim Report
C. E. Newman 20 Oct. 1971 26 p refs
(Contract N00014-67-A-0112-0062; NR Proj. 323-009)
(AD-751043; SU-IPR-491) Avail: NTIS CSCL 04/1

Equations are derived which govern modulation of a continuous wave whistler-mode transition by resonant particles in a region limited in spatial extent. It is found that nonlinear wave-particle interaction results in amplitude modulation but not phase modulation. An integral equation is found which gives the temporal behavior of the amplitude of the signal emerging from the region. Analysis of this equation will be done numerically in a later paper. Author (GRA)

N73-16951 Tokyo Univ. (Japan). Ocean Research Inst.
PROBLEM OF TIDAL CURRENT ELLIPSES
Koji Hidaka *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 9-13 refs (For availability see N73-16950 07-34)

N73-16953 Academy of Sciences (USSR), Moscow. Inst. of Oceanology.
ON THE SUMMER DAILY HEATING AND DIURNAL HEAT BUDGET OF THE UPPER OCEAN LAYER
K. N. Fedorov *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 27-40 refs (For availability see N73-16950 07-34)

N73-16954 Naval Undersea Center, San Diego, Calif.
ROUGHNESS OF THE THERMOCLINE
K. G. LaFond and E. C. LaFond *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 41-54 refs (For availability see N73-16950 07-34)

N73-16955 Environmental Prediction Research Facility (Navy), Monterey, Calif.
NUMERICAL ANALYSIS OF OCEAN SURFACE CURRENTS
S. Larson and T. Laevastu *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 55-74 refs (For availability see N73-16950 07-34)

N73-16956 Institute of Oceanology, Gelendjik (USSR).
ON THE INFLUENCE OF A BOTTOM TOPOGRAPHY AND THE EARTH'S ROTATION ON THE WIND-DRIVEN CIRCULATION IN THE MEDITERRANEAN SEA
L. M. Fomin and L. V. Moskalenko *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 75-90 refs (For availability see N73-16950 07-34)

N73-16957 Woods Hole Oceanographic Institution, Mass.
TEMPERATURE-SALINITY REGIME IN A NORTH-SOUTH SECTION OF THE TYRRHENIAN SEA
Arthur R. Miller *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 91-100 refs (For availability see N73-16950 07-34)
(Contrib-2725)

N73-16958 Istituto Universitario Navale, Naples (Italy).
HYDROLOGY OF THE SICILIAN CHANNEL. S.S. DECTRA, OCTOBER 1969 [IDROLOGIA DEL CANALE DI SICILIA. NAVE DECTRA, OTTOBRE 1969]
A. DeMaio, M. Moretti, E. Sansone, and D. Bregant (Ist. Sper. Talassografico) *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 101-137 refs In ITALIAN (For availability see N73-16950 07-34)

N73-16960 Institute of Marine Research, Helsinki (Finland).
THE COMPLEXITY OF THE PROBLEM OF MEAN SEA LEVEL
Eugenie Lisitzin *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 157-162 refs (For availability see N73-16950 07-34)

N73-16961 Osservatorio Geofisico Sperimentale, Trieste (Italy).
THE ADRIATIC SEA: CALCULATION OF NEW HARMONIC CONSTANTS FOR SOME HARBORS [LE MAREE DELL' ADRIATICO: CALCOLI DI NUOVE COSTANTI ARMONICHE PER ALCUNI PORTI]
F. Mosetti and B. Manca *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 163-177 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

N73-16962 Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
INFLUENCE OF CHEMICAL MEDIATORS ON THE OCEANIC INTER-SPECIES RELATIONSHIPS [INFLUENCE DES MEDIATEURS CHIMIQUES SUR LES RELATIONS INTER-ESPECES OCEANIQUES]
M. Aubert *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 179-184 refs In FRENCH (For availability see N73-16950 07-34)

N73-16963 Istituto Universitario Navale, Naples (Italy).
THE MEAN TEMPERATURE OF THE STANDARD ATMOSPHERE AND ALTIMETRIC CORRECTIONS [TEMPERATURA MEDIA DELL'ARIA TIPO E CORREZIONI ALTIMETRICHE]
Guiseppe Simeon *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 185-193 In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

N73-16966 Istituto Universitario Navale, Naples (Italy). Ist. di Meteorologia e Oceanografia.
THE CARBON DIOXIDE CONCENTRATION IN VARIOUS ITALIAN AND SCANDINAVIAN CITIES [IL CO2 IN ALCUNE LOCALITA ITALIANE E SCANDINAVE]
A. DeMaio, W. Bischof (Inst. of Meteorol., Stockholm), M. Moretti, and E. Sansone *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 219-234 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

N73-16968 Consiglio Nazionale delle Ricerche, Milan (Italy). Lab. per la Geofisica della Litosfera.
MEASUREMENT OF THE THERMAL INFRARED FIELD: FIRST APPLICATIONS TO GEOPHYSICS IN ITALY [LE MISURE NEL CAMPO DELL'INFRAROSSO TERMICO: PRIME APPLICAZIONI ALLE SCIENZE DELLA TERRA IN ITALIA]
R. Cassinis, G. M. Lechi, and A. M. Tonelli *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 243-252 In ITALIAN (For availability see N73-16950 07-34)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-16483* National Aeronautics and Space Administration, Washington, D.C.
SYSTEM FOR INDICATING DIRECTION OF INTRUDER AIRCRAFT Patent
Anne W. Story, inventor (to NASA) Issued 2 Jan. 1973 8 p Filed 16 Mar. 1971 Continuation-in-part of abandoned US Patent Appl. SN-808822, filed 20 Mar. 1969
(NASA-Case-ERC-10226-1; US-Patent-3,708,671; US-Patent-Appl-SN-124909; US-Patent-Class-250-209; US-Patent-Class-250-215; US-Patent-Class-250-217; US-Patent-Class-315-153; US-Patent-Class-340-25; US-Patent-Class-340-27R; US-Patent-Appl-SN-808822) Avail: US Patent Office CSCL 14B

A pilot warning indicator system consisting of a flashing

beacon, a detector, and an indicating panel is described. The detector responds to radiant energy from another aircraft's beacon by energizing particular signal lamps positioned in the periphery of the pilot's normal field of view. Since the positions of the energized lamps are related to the direction from which radiant energy is received by the detector, the pilot is apprised of the relative position of an intruder aircraft without any shift in visual fixation. Official Gazette of the U.S. Patent Office

N73-16484* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMBUSTION DETECTOR Patent
Robert L. Trimpi, John E. Nealy, and William L. Grose, inventor (to NASA) Issued 2 Jan. 1973 4 p Filed 16 Apr. 1971 Supersedes N72-21423 (10 - 12, p 1609)
(NASA-Case-LAR-10739-1; US-Patent-3,708,674; US-Patent-Appl-SN-134567; US-Patent-Class-250-217F; US-Patent-Class-340-228S; US-Patent-Class-340-418) Avail: US Patent Office CSCL 14B

A device has been developed for generating a rapid response signal upon the radiation-emitting combustion reaction of certain gases in order to provide a means for the detection and identification of such reaction and concurrently discriminate against spurious signals. This combustion might be the first stage of a coal mine explosion process, and thereby this device could provide a warning of the impending explosion in time to initiate quenching action. This device has the capability of distinguishing between the light emitted from a combustion reaction and the light emitted by miners' lamps, electric lamps, welding sparks or other spurious events so that the quenching mechanism is triggered only when an explosion-initiating combustion occurs. Official Gazette of the U.S. Patent Office

N73-16485*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
STUDY OF THE DETAIL CONTENT OF APOLLO ORBITAL PHOTOGRAPHY Final Report
Robert E. Kinzly 29 Sep. 1972 70 p refs
(Contract NSR-33-009-087)
(NASA-CR-130378; CAL-VT-2912-O-1) Avail: NTIS HC $5.50 CSCL 14E

The results achieved during a study of the Detail Content of Apollo Orbital Photography are reported. The effect of residual motion smear or image reproduction processes upon the detail content of lunar surface imagery obtained from the orbiting command module are assessed. Data and conclusions obtained from the Apollo 8, 12, 14 and 15 missions are included. For the Apollo 8, 12 and 14 missions, the bracket-mounted Hasselblad camera had no mechanism internal to the camera for motion compensation. If the motion of the command module were left totally uncompensated, these photographs would exhibit a ground smear varying from 12 to 27 meters depending upon the focal length of the lens and the exposure time. During the photographic sequences motion compensation was attempted by firing the attitude control system of the spacecraft at a rate to compensate for the motion relative to the lunar surface. The residual smear occurring in selected frames of imagery was assessed using edge analyses methods to obtain and achieved modulation transfer function (MTF) which was compared to a baseline MTF. Author

N73-16486*# Teledyne Brown Engineering, Huntsville, Ala.
DEVELOPMENT OF TECHNIQUES FOR ADVANCED OPTICAL CONTAMINATION MEASUREMENT WITH INTERNAL REFLECTION SPECTROSCOPY, PHASE 2, VOLUME 2 Final Report
J. D. Hayes Dec. 1972 48 p
(Contract NAS9-12571)
(NASA-CR-128716; SE-NASA-1674-Vol-2) Avail: NTIS HC $4.50 CSCL 14B

Attenuated total reflectance spectra of individual contaminants in space simulation chambers are presented as well as spectra of mixtures and figures exhibiting the effects of film thickness on reflectance spectra. Detailed calibration spectra were made for three selected concentrations (film thickness) for two contaminants and for one concentration for all contaminants. Author

N73-16487*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF GRID TRANSPARENCY AND FINITE COLLECTOR SIZE ON DETERMINING ION TEMPERATURE AND DENSITY BY THE RETARDING POTENTIAL ANALYZER
B. E. Troy, Jr. and E. J. Maier Jan. 1973 27 p refs Submitted for publication
(NASA-TM-X-66153; X-621-72-495) Avail: NTIS $3.50 CSCL 14B

The analysis of ion data from retarding potential analyzers (RPA's) is generally done under the planar approximation, which assumes that the grid transparency is constant with angle of incidence and that all ions reaching the plane of the collectors are collected. These approximations are not valid for situations in which the ion thermal velocity is comparable to the vehicle velocity, causing ions to enter the RPA with high average transverse velocity. To investigate these effects, the current-voltage curves for H+ at 4000 K were calculated, taking into account the finite collector size and the variation of grid transparency with angle. These curves are then analyzed under the planar approximation. The results show that only small errors in temperature and density are introduced for an RPA with typical dimensions; and that even when the density error is substantial for non-typical dimensions, the temperature error remains minimal. Author

N73-16488*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN AND ANALYSIS OF A STAR IMAGE MOTION COMPENSATOR
K. C. Romanczyk, Aaron J. Ostroff, and W. E. Howell Washington Feb. 1973 34 p refs
(NASA-TN-D-7145; L-8634) Avail: NTIS HC $3.00 CSCL 14B

The feasibility of designing and fabricating a small optical system to compensate for motions of a stellar field image on the focal plane of a large orbiting telescope is examined for a single-axis system. An all-reflecting two-mirror star image motion compensator maintains both a flat focal plane and image focus for one or more star images. Both theoretical and experimental evaluations show that only one adjustment is needed to aline the system since the change in focus is linearly related to the misalinements of all critical components. Results of an error analysis show that the focus error resulting from fabrication tolerances is very small compared to the adjustment capability of the system. Author

N73-16489*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
MINIMUM DISTANCE CLASSIFICATION IN REMOTE SENSING
A. G. Wacker (Saskatchewan Univ.) and D. A. Landgrebe 9 Feb. 1972 26 p refs Presented at 1st Can. Symp. for Remote Sensing, Ottawa, 7-9 Feb. 1972
(Grant NGL-15-005-112)
(NASA-CR-130030; LARS-Print-030772) Avail: NTIS HC $3.50 CSCL 14B

The utilization of minimum distance classification methods in remote sensing problems, such as crop species identification, is considered. Literature concerning both minimum distance classification problems and distance measures is reviewed. Experimental results are presented for several examples. The objective of these examples is to: (a) compare the sample classification accuracy of a minimum distance classifier, with the vector classification accuracy of a maximum likelihood classifier, and (b) compare the accuracy of a parametric minimum distance classifier with that of a nonparametric one. Results show the minimum distance classifier performance is 5% to 10% better than that of the maximum likelihood classifier. The nonparametric classifier is only slightly better than the parametric version. Author

N73-16490*# Translation Consultants, Ltd., Arlington, Va.
CONTROL SYSTEM FOR AUTOMATIC OPERATION OF THE ORION EQUIPMENT
M. N. Krmoyan, A. Z. Zakharyan, and Sh. M. Arutyunyan Washington NASA Jan. 1973 11 p refs Transl. into ENGLISH from Soobshch. Byurakansk. Observ., Akad. Nauk Arm. SSR (Erevan), no. 45, 1972 p 27-35
(Contract NASw-2038)

(NASA-TT-F-14583) Avail: NTIS HC $3.00 CSCL 14B

A description of the electric scheme of orientation and tracking of the Orion system is given. The method of operation of the system is set forth along with a description of the function of several parts: the photoguide, the control desk, and the sight. Reasons for the choice of the method of pulse-width modulation are given. Block diagrams of the whole system, the follow-up system, and the photoguide are provided. The method of estimating the dynamics of the follow-up system is concisely formulated. Through harmonic balance, the effect on the stability of the gas system in the reducer is examined. A scheme of the amplifying part of the follow-up system with a detailed description of its function is provided. The experimental curve is presented of the transient process in the development of the unit-jump, slightly differing from the calculated jump and indicating that the follow-up system meets the technical requirements assigned. The basic technical conditions are given. Author

N73-16491*# Translation Consultants, Ltd., Arlington, Va.
ENERGY CALIBRATION OF THE 'ORION' SPECTROGRAPH
G. A. Gurzadyan, Dzh. B. Oganesyan, and R. A. Yepremyan Washington NASA Jan. 1973 7 p refs Transl. into ENGLISH from Soobshch. Byurakansk. Observ., Akad. Nauk Arm. SSR (Erevan), no. 45, 1972 p 36-41
(Contract NASw-2038)
(NASA-TT-F-14584) Avail: NTIS HC $3.00 CSCL 14B

The Orion telescope with a spectrograph designed to obtain shortwave spectrograms of the stars, was energy-calibrated in the range of 2000 to 3800 A before its installation in the Salyut orbital station. Sychrotron radiation was used from the electronic circular accelerator, with maximum energy of electrons 6 GeV. The calibration resulted in the curve of relative sensitivity of the entire Orion optical system and the photoemulsion applied. This curve can now be used to determine the law of the actual distribution of energy in the continuous spectrum of stars.
Author

N73-16492*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATION OF THE PHOTOGRAPHIC CHARACTERISTICS OF UFSh-4 FILM USED IN THE ORION EQUIPMENT
V. M. Uvarova, M. R. Shpolskiy, A. N. Oshurkov, Dzh. B. Oganesyan, and N. V. Uvarova Washington NASA Jan. 1973 7 p refs Transl. into ENGLISH from Soobshch. Byurakansk. Observ., Akad. Nauk Arm. SSR (Erevan), no. 45, 1972 p 42-47
(Contract NASw-2038)
(NASA-TT-F-14585) Avail: NTIS HC $3.00 CSCL 14E

Adequately sensitive film of the UFSh-4 type, with high resolution capacity, was used in the range of wavelengths 4000-1800 A to obtain spectrograms of particular stars with the help of the Orion orbital observatory. The possibility of prolonged orbiting of this film in the conditions of outer space (over two months) was established. The sensitivity of this film has practically remained unchanged over the past period despite the heavy fogginess formed (with a density of about 0.8-0.9). No appreciable changes in the physicomechanical characteristics of the emulsion layer of the above film were discovered. Author

N73-16493*# Xerox Electro-Optical Systems, Pasadena, Calif.
REAL-TIME OPTICAL ALIGNMENT AND DIAGNOSTIC SYSTEM (ROADS) Final Report
17 Nov. 1972 189 p
(Contract NAS9-11385)
(NASA-CR-128712; EOS-4065) Avail: NTIS HC $11.50 CSCL 14B

The ultimate and most frequent usage of ROADS will be the alignment of subassemblies (collector and collimator) prior to their installation in a chamber. The system as designed has inherent associated capabilities well applied to acceptance testing of the No. 4 mirror, prediction of in-chamber performance, generation of a catalog of test results and other data, providing data for the plotting of isointensity lines, and other applications which are discussed. The ROADS system will collect, process, display, analyze, and retain data as required for components, partial subassemblies, complete subassemblies, complete modules, and multimodular arrays. Author

N73-16494*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A THREE STAGE SAMPLING MODEL FOR REMOTE SENSING APPLICATIONS
Ludwig M. Eisgruber [1972] 28 p refs
(Grant NGL-15-005-112)
(NASA-CR-130026; , Inform-Note-021072) Avail: NTIS HC $3.50 CSCL 14E

A conceptual model and an empirical application of the relationship between the manner of selecting observations and its effect on the precision of estimates from remote sensing are reported. This three stage sampling scheme considers flightlines, segments within flightlines, and units within these segments. The error of estimate is dependent on the number of observations in each of the stages. G.G.

N73-16495*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
THE IMPORTANCE OF GROUND TRUTH DATA IN REMOTE SENSING
Roger M. Hoffer [1972] 13 p refs Presented at UN Panel Meeting on the Estab. and Implementation of Res. Programs in Remote Sensing, San Jose dos Campos, Brazil, 29 Nov. - 10 Dec. 1971
(Grant NGL-15-005-112)
(NASA-CR-130020; LARS-Print-120371) Avail: NTIS HC $3.00 CSCL 14E

Surface observation data is discussed as an essential part of remote sensing research. One of the most important aspects of ground truth is the collection of measurements and observations about the type, size, condition and other physical or chemical properties of importance concerning the materials on the earth's surface that are being sensed remotely. The use of a variety of sensor systems in combination at different altitudes is emphasized. F.O.S.

N73-16496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COOLED-GAS PYROMETER FOR USE IN HYPERSONIC ENGINE TESTING
George E. Glawe Washington Feb. 1973 18 p refs
(NASA-TM-X-2715; E-7214) Avail: NTIS HC $3.00 CSCL 14B

A cooled-gas pyrometer designed for application in a hypersonic research engine program was fabricated and tested. Design and operational considerations and calibration data are presented. The probe was tested in a rocket-engine exhaust stream operating at Mach 2 and 2300 K. Test temperature measurements agreed to within 2 percent with a radiation shielded thermocouple probe. Author

N73-16497*# National Bureau of Standards, Washington, D.C. Instrumentation Applications Section.
DURABILITY INVESTIGATION OF A GROUP OF STRAIN GAGE PRESSURE TRANSDUCERS
Paul S. Lederer and John S. Hilten Dec. 1972 59 p refs
(NASA Order C-337-C; NBS Proj. 4253446)
(NASA-CR-120953; NBSR-10-975; NBS-10975) Avail: NTIS HC $5.00 CSCL 14B

A durability investigation was conducted on a group of eighteen bonded-wire strain gage pressure transducers with ranges of 0 to 15 psig and 0 to 100 psig using an improved version of a previously developed technique. Some of the transducers were subjected to 40 million pressure cycles at a 5-Hz rate at laboratory ambient conditions, others were cycled at a temperature of 150 F (65.6 C). The largest change in sensitivity observed was 0.22% for a 100-psig transducer subjected to 40 million pressure cycles at 150 F. The largest change in zero pressure output observed was 0.91% FS for the same transducer. None of the transducers failed completely as a result of cycling at or below full scale pressure. Author

N73-16498*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FIRST-ORDER OPTICAL ANALYSIS OF A QUASI-MICROSCOPE FOR PLANETARY LANDERS
Friedrich O. Huck, Archibald R. Sinclair, and Ernest E. Burcher Washington Feb. 1973 30 p refs
(NASA-TN-D-7129; L-8527) Avail: NTIS HC $3.00 CSCL 20F

A first-order geometrical optics analysis of a facsimile camera augmented with an auxiliary lens as magnifier is presented. This concept, called quasi-microscope, bridges the gap between surface resolutions of the order of 1 to 10 mm which can be obtained directly with planetary lander cameras and resolutions of the order of 0.2 to 10 microns which can be obtained only with relatively complex microscopes. A facsimile camera was considered in the analysis; however, the analytical results can also be applied to television and film cameras. It was found that quasi-microscope resolutions in the range from 10 to 100 microns are obtainable with current state-of-the-art lander facsimile cameras. For the Viking lander camera having an angular resolution of 0.04 deg, which was considered as a specific example, the best achievable resolution would be about 20 microns. The preferred approach to increase the resolution of the quasi-microscope would be, if possible, through an increase in angular resolution of the camera. A twofold to threefold improvement in resolution could also be achieved with a special camera focus position, but this approach tends to require larger and heavier auxiliary optics. Author

N73-16499# Oak Ridge National Lab., Tenn.
IONIZATION CHAMBER CURRENT QUANTIZER FOR RADIOLOGICAL ENVIRONMENTAL MONITORING SYSTEM
F. M. Glass Aug. 1972 24 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3906) Avail: NTIS

A current-to-frequency converter was developed as an ionization chamber current quantizer. This instrument measures currents without range switching, which corresponds to a radiation range from 0.5 to 10,000 R/hr when used with a 1000-cc standard air equivalent chamber. The output of the converter is positive pulses having a frequency directly proportional to the ionization current. The calibration is adjustable. Built-in current sources enable a check of the calibration. The instrument has a high tolerance for gamma radiation, humidity, and ambient temperature. Author (NSA)

N73-16500# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
AERIAL SNOW GAUGING USING NATURAL TERRESTRIAL GAMMA RADIATION
A. E. Fritzsche and Z. G. Burson Aug. 1972 21 p refs Presented at 2d Conf. on Natural Radiation Environment, Houston, Tex., 7 Aug. 1972
(EGG-1183-1557; Conf-720805-2) Avail: NTIS

Aerial snow gaging using the transmitted terrain gamma radiation was shown to be practical. The accuracy of about 10 percent is expected to improve as techniques for evaluating airborne radon-daughter contributions are developed and as the peak area extraction from spectral data is perfected. Both the gross count and peak area techniques will provide this accuracy. Author (NSA)

N73-16501# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
AERIAL RADIOLOGICAL MEASURING SYSTEM PROGRAM
J. F. Doyle 1972 33 p refs Presented at 2d Conf. on Nat. Radiation Environment, Houston, Tex., 7 Aug. 1972 Sponsored by AEC
(EGG-1183-1558; Conf-720805-4) Avail: NTIS

The operation of the Aerial Radiological Measuring System (ARMS) which consists of an aircraft carrying a radiation measuring system that includes a detector array, channel analyzers, computers, digital display and recording equipment, is described and experience in its use for routine and emergency missions is discussed. It is concluded that ARMS has demonstrated how state-of-the-art research and technology can be applied to practical situations and that aerial survey systems would be invaluable to the nuclear safety program should there be an emergency. ARMS is expected to play its most active nuclear safety role through routine surveillance of areas which include nuclear facilities. Research to develop further refinements in the system is recommended. NSA

N73-16502# California Univ., Livermore. Lawrence Livermore Lab.
ULTRAFAST STREAKING CAMERA FOR PICOSECOND LASER DIAGNOSTICS
S. W. Thomas, G. R. Tripp, and L. W. Coleman Jul. 1972 24 p refs Presented at 10th Intern. Congr. on High Speed Phot., Nice, 25-30 Sep. 1972 Sponsored by AEC
(UCRL-73734; Conf-720924-1) Avail: NTIS

A compact, ultrafast streaking camera, small and light enough to be carried about in a suitcase size package, is described. Powering requirements are low. Resolution is 10 psec and will allow pulse widths to be resolved to between 4 and 7 psec. Photon triggered, avalanche transistor sweep circuitry is used producing less than 100 psec jitter between trigger initiation and start of the sweep. Electronic circuitry and construction details are provided. Author

N73-16503# Sandia Labs., Albuquerque, N.Mex.
NEW PULSED POWER STRAIN GAGE SYSTEM
[1972] 9 p Sponsored by AEC
(SC-DC-721413) Avail: NTIS

A version of the pulsed power strain-gage system which retains the advantages of the standard system while overcoming most of the disadvantages is described. This system will be used at a testing laboratory to obtain strain data in the presence of high amplitude electrical noise. Author

N73-16504# Royal Aircraft Establishment, Farnborough (England).
COLOUR OR MONOCHROME FILMS IN LABORATORY EXPERIMENTS ON THE ACQUISITION OF GROUND TARGETS FROM MEDIUM ALTITUDE
W. F. Fielding May 1972 28 p ref
(RAE-TR-72064; BR-29305) Avail: NTIS HC $3.50

Three laboratory simulation experiments to compare target acquisition performance obtained using monochrome and color films of identical routes and targets are described. It is concluded that monochrome films give similar results to those obtained with color films for relatively prominent targets capable of being acquired at long ranges in: experiments which involve first-pass detection range measurements, or experiments involving potential range measurements. The adequacy of monochrome films for simulating the acquisition of more difficult targets, only capable of being acquired at short ranges, or more difficult navigation tasks remains untested. Author (ESRO)

N73-16505# Institut Franco-Allemand de Recherches, St. Louis (France).
MASS SPECTROMETRIC INVESTIGATION OF HYPERSONIC AIR FLOW Ph.D. Thesis - Freiburg Univ., 1971 [MASSENSPEKTROMETRISCHE UNTERSUCHUNG IN HYPERSCHALL-LUFT-STROEMUNGEN]
H. Trinks Bonn Bundeswehramt 1972 115 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-72-20) Avail: NTIS HC $7.75; Bundeswehramt 25 DM

A mass spectrometer is described that operates without a magnetic field, and enables the concentration of the various constituents of one gas to be determined simultaneously and continuously with a high time resolution. It is used for the investigation of hypersonic air flows in a shock tube, in connection with reentry body problems. The analyses carried out yield information on the evolution of relative concentrations, blowing times of the hypersonic flows, events occurring in the zone of the hydrogen-air mixture located behind the steady flow, and disturbances arising from the fragments of the diaphragm and acting on the measurements. The dissociation coefficient of nitrogen and oxygen was determined in the upstream flow and at the stagnation point of a hemispherical model, where different types of ions were observed. Author (ESRO)

N73-16506# Bureau of Mines, Washington, D.C.
A SOLID-STATE AMPLIFIER FOR THE BRIDGE CIRCUIT OF A MERCURY DETECTOR
C. Melvin Lepper Sep. 1972 15 p refs
(PB-212658; BM-RI-7676) Avail: NTIS HC $3.00 CSCL 14B

A solid state amplifier for the bridge circuit of an atomic absorption mercury detector is presented and described. Operational advantages over previously used circuity include

improved time and temperature stability, increased measurement accuracy, and simplified setup, calibration and operation.
Author (GRA)

N73-16507# Badger Meter Mfg. Co., Milwaukee, Wis.
NUCLEAR MAGNETIC RESONANCE MASSMETRIC FLOWMETER Final Report, 15 Mar. 1967 - 31 May 1972
William K. Genthe, William H. VanderHeyden, and Joseph H. Battocletti Wright-Patterson AFB, Ohio AFFDL Jun. 1972 117 p
(Contract F33615-67-C-1488; AF Proj. 8224)
(AD-751507; AFFDL-TR-72-53) Avail: NTIS CSCL 14/2

Based on earlier research work in the measurement of jet and rocket propellants by means of Nuclear Magnetic Resonance (NMR), a propellant mass flow meter based on the NMR principle was designed and constructed. The mass flow measurement is derived by multiplying flow velocity determined by means of NMR, by fluid density determined using a vibrating beam densitometer. The NMR velocimeter measures the velocity of the propellant without moving parts or direct contact with the liquid. Attempts to reduce the size and weight of the velocimeter for airborne applications were unsuccessful, primarily because of the required size and weight for the magnetizing and detection fields. While practical for ground installations, the resulting size and weight of the primary element made it unsuited to airborne applications.
Author (GRA)

N73-16508# Naval Training Equipment Center, Orlando, Fla. Physical Sciences Lab.
MULTICOLOR HOLOGRAPHY
Windell N. Mohon, Alfred H. Rodemann, and Denis R. Breglia Aug. 1972 21 p refs
(AD-751560; NAVTRAEQUIPCEN-TN-26) Avail: NTIS CSCL 14/5

The problems involved in making multicolor holograms are discussed, including spurious images and color rendition. Eight methods for constructing a multicolor hologram are presented with their advantages and shortcomings. The problems of experimental set up, film sensitivity, development, and relative luminous efficiency of the eye are mentioned. Color photographs of the best results are shown. The large object to reference beam angle method is recommended for first attempts at making a color hologram. The general formula for the reconstruction angle from a color hologram is derived.
Author (GRA)

N73-16509# Illinois Univ., Urbana. Coordinated Science Lab.
SYNTHETIC HOLOGRAMS AND IMAGE RECONSTRUCTION FROM ACOUSTIC OR MICROWAVE FIELD PATTERNS
Themistocles H. Demetrakopoulos and Raj Mittra Oct. 1972 83 p refs
(Contract DAAB07-67-C-0199; UILU-ENG-72-2253)
(AD-751408; R-591) Avail: NTIS CSCL 14/5

Optical reconstruction applied to holograms that have been recorded at microwave, acoustic or other sub-optical frequencies produces a longitudinally distorted image, unless the original hologram has been reduced by the ratio of the recording to reconstructing wavelength. Since the required reduction ratio is very large it is difficult to achieve it in practice. Also, a hologram reduced in this manner reproduces an image that is extremely small. In this investigation a technique is presented for the reduction, or complete elimination, of the longitudinal distortion in three-dimensional imaging from synthetic holograms. The object is longitudinally demagnified in the recording process, an optical hologram is synthesized and subsequently reduced by a suitable factor. In addition to the optical reconstruction technique, digital reconstruction has also been applied to simulated acoustic or microwave diffraction patterns. In this method the transverse cross-sections of three-dimensional objects are evaluated and sequentially displayed on a CRT.
GRA

N73-16510# Naval Research Lab., Washington, D.C. Solid State Div.
TRANSIENT RADIATION EFFECTS ON DETECTORS Interim Progress Report, 1 Jul. 1971 - 30 Jun. 1972
W. J. Moore, P. L. Radoff, and B. Molnar Oct. 1972 24 p refs
(AD-751540; NRL-MR-2519) Avail: NTIS CSCL 17/5

Experimental and theoretical effects of displacement damage to infrared detectors from high energy neutrons was studied. Material parameters which can be radiation dependent and which affect detector performance were identified. Theoretical studies are presented for both photoconductive and photovoltaic detectors. Experimental results for lead sulfide detectors are presented. Degradation of detector performance has been observed for neutron fluences greater than 10 to the 12th power neutrons /sq cm.
Author (GRA)

N73-16511# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THEORETICAL RESPONSE OF THE DEEP RIVER NEUTRON MONITOR TO AN ANISOTROPIC SOLAR COSMIC-RAY EVENT Environmental Research Papers
M. A. Shea and D. F. Smart 28 Jul. 1972 31 p refs
(AF Proj. 8600)
(AD-751275; AFCRL-72-0456; AFCRL-ERP-407) Avail: NTIS CSCL 04/1

The response of the Deep River, Canada neutron monitor to an anisotropic flux of solar cosmic rays is a function of the viewing direction of the detector through the magnetosphere, as defined by the asymptotic cone of acceptance, and the interplanetary direction and spatial distribution of the flux anisotropy. Using a mathematical model of the magnetosphere, the authors have calculated the viewing directions for Deep River as a function of time and evaluated the response of the neutron monitor to various solar cosmic-ray anisotropies propagating along the ecliptic plane.
Author (GRA)

N73-16512# Picatinny Arsenal, Dover, N.J.
THE ARM SAFE DEVICE DUD LOCK TESTER (AN APPLICATION OF FLUIDIC TIMING AND CONTROL TO TEST EQUIPMENT)
Jon G. Rayner Apr. 1972 19 p
(AD-751127; PA-TM-2042) Avail: NTIS CSCL 14/2

A Tester controlled by a fluidic logic system has been constructed to test the safety functions of missile safe and arm devices. The tester mechanically sequences the acceleration sensing elements of a safe and arm device with forces applied through air cylinders. The air cylinders are controlled by a fluidic logic and timing circuit with continuously variable time sequences programmable. The tester has been successfully demonstrated to meet extremely accurate time requirements (plus or minus 20 milliseconds over one second intervals) and plans are being made for its use in production acceptance testing.
Author (GRA)

N73-16513# Harry Diamond Labs., Washington, D.C.
ERRORS IN STREAK PHOTOGRAPHY MEASUREMENTS CAUSED BY SUBJECT AND CAMERA MISALIGNMENT
D. J. Mary Aug. 1972 30 p refs
(DA Proj. 1W2-62301-A-301; HDL Proj. A2185)
(AD-751185; HDL-TR-1609) Avail: NTIS CSCL 14/5

Streak-camera photography can be used to determine velocity and acceleration of projectiles during impact. The values obtained from these photographs are subject to errors such as caused by the trajectory canted relative to the camera slit (azimuthal misalignment), the trajectory tilted relative to the camera axis, and improper focus, resulting in a magnification error. For the velocity range of projectiles fired from the 4-in. air gun (400 to 800 ft/sec) and the optical parameters of the HDL streak camera, angles of trajectory cant up to 10 degrees and displacements of the trajectory by as much as 10 percent from the normal object plane (magnification error) result in velocity and acceleration errors of less than 10 percent. Trajectory tilt, however, introduces pseudo-acceleration into the photograph even when the projectile moves with uniform velocity. For a 10-degree tilt angle, the pseudo-acceleration may be as high as 120,000 ft/sec squared.
Author (GRA)

N73-16514# Army Aviation Systems Test Activity, Edwards, AFB, Calif.
A PORTABLE INSTRUMENTATION KIT FEASIBILITY STUDY Report for 22 May 1970 - Nov. 1971
Robert P. Jefferis and William T. Rivers Jun. 1972 46 p refs
(USAAVSCOM Proj. 70-17)
(AD-751188; USAASTA-70-17) Avail: NTIS CSCL 14/2

The purpose of this study was to investigate the feasibility

of developing an airborne instrumentation kit that could be easily transported and quickly installed. The system would need to be compatible with anticipated US Army vehicle and test requirements. Results show that a system can be developed which will meet the requirements for all but the most extensive testing. The system will also interface with existing instrumentation and data processing systems. The weight of the system is estimated to be 30 pounds with dimensions of 12 by 15 by 9 inches. The cost is expected to be approximately $90,000.
Author (GRA)

N73-16363* United Nations Development Program.
BENEFIT ANALYSES AND DECISION MODELS
M. Michael Gucovsky *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1973 p 183-184 (For availability see N73-16348 07-14)
CSCL 14B

N73-16373* Michigan Univ., Ann Arbor.
INTRODUCTION TO SENSORS
Gwynn H. Suits *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 239-243 (For availability see N73-16348 07-13)
CSCL 14B

N73-16375* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AERIAL CAMERAS, AERIAL FILMS, AND FILM PROCESSING
Richard W. Underwood *In its* Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 263-276 refs (For availability see N73-16348 07-13)
CSCL 14E

N73-16376* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH OBSERVATION SENSORS
William Nordberg *In its* Intern. Workshop on Earth Resources Surv. Systems, Vol. 1 1972 p 277-281 (For availability see N73-16348 07-13)
CSCL 14B

N73-16383* California Univ., Berkeley. Forestry Remote Sensing Lab.
THE USE OF SMALL SCALE AERIAL PHOTOGRAPHY IN A REGIONAL AGRICULTURAL SURVEY
William C. Draeger *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 14 May 1971 p 2-12 refs (For availability see N73-16382 07-13)
CSCL 14E

N73-16384* Agricultural Research Service, Weslaco, Tex. Soil and Water Conservation Research Div.
PHOTOGRAPHIC REMOTE SENSING OF SICK CITRUS TREES
Harold W. Gausman *In* NASA, Washington Intern. Workshop of Earth Resources Surv. Systems, Vol. 2 1971 p 14-30 refs (For availability see N73-16382 07-13)
CSCL 02C

N73-16385* California Univ., Berkeley. Forestry Remote Sensing Lab.
TESTING MULTIBAND AND MULTIDATE PHOTOGRAPHY FOR CROP IDENTIFICATION
D. T. Lauer *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 32-46 refs (For availability see N73-16382 07-13)
CSCL 02D

N73-16387* Agricultural Research Service, Weslaco, Tex. Soil and Water Conservation Research Div.
AGRICULTURAL APPLICATIONS AND REQUIREMENTS FOR THERMAL INFRARED SCANNERS
Craig L. Wiegand *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 66-81 refs (For availability see N73-16382 07-13)
CSCL 02C

N73-16390* Northern Forest Fire Lab., Missoula, Mont.
APPLICATION OF INFRARED SCANNERS TO FOREST FIRE DETECTION
Stanley N. Hirsch *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 152-169 refs (For availability see N73-16382 07-13)
(Proj. Fire Scan)
CSCL 02F

N73-16843 Minnesota Univ., Minneapolis.
ASTROMETRY WITH SCHMIDT TELESCOPES
W. J. Luyten and A. E. LaBonte *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 33-38 refs (For availability see N73-16840 07-30)

N73-16845 Strasbourg Univ. (France). Observatoire Astronomique.
USE OF THE SCHMIDT TELESCOPE FOR ASTROMETRY [EMPLOI DU TELESCOPE DE SCHMIDT EN ASTROMETRIE]
P. Bru and P. Lacroute *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 45-49 refs In FRENCH (For availability see N73-16840 07-30)

N73-16846 Warner and Swasey Observatory, Cleveland, Ohio.
OBJECTIVE-PRISM SPECTRAL WORK
W. P. Bidelman *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 53-60 refs (For availability see N73-16840 07-30)

N73-16847 Bonn Univ. (West Germany). Astronomische Inst.
A PROPOSAL FOR A FLINT OBJECTIVE PRISM FOR THE ESO SCHMIDT CAMERA
E. H. Geyer *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 61-62 (For availability see N73-16840 07-30)

N73-16848 Instituto Venezolano de Astronomia, Merida.
RADIAL VELOCITIES FROM OBJECTIVE PRISM PLATES
J. Stock and W. Osborn *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 63-64 (For availability see N73-16840 07-30)

N73-16852 Northwestern Univ., Evanston, Ill. Dept. of Astronomy.
SURFACE COLOUR PHOTOMETRY OF GALAXIES WITH SCHMIDT TELESCOPES
J. D. Wray *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 87-96 refs Sponsored in part by UK Sci. Res. Council and European Southern Obs. (For availability see N73-16840 07-30)

N73-16858 Arizona Univ., Tucson. Optical Sciences Center.
AURA SCHMIDT TELESCOPE PROGRAMME
R. Buchroeder and R. Lynds (Kitt Peak Natl. Obs.) *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 127-134 (For availability see N73-16840 07-30)

N73-16859 European Southern Observatory, Hamburg (West Germany).
THE ESO SCHMIDT TELESCOPE
O. Heckmann *In its* The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 137-139 (For availability see N73-16840 07-30)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-16515*# Bertea Corp., Irvine, Calif.
DESIGN AND EVALUATION OF AN ELECTROHYDRAULIC SERVOACTUATOR USING ACTIVE STANDBY REDUNDANCY Final Progress Report

R. L. Anderson and W. E. Cover 12 Sep. 1972 209 p
(Contract NAS8-27821)
(NASA-CR-124027; Bertea-221400-17) Avail: NTIS HC $12.50 CSCL 13I

The application is described of active standby redundancy techniques to a large electrohydraulic servoactuator. The advantages and limitations of active standby redundancy are identified. Special areas of investigation during the development test phase of the program were the evaluation of output transients as a function of channel switching and the nuisance switching characteristics of the system. The feasibility of constructing large electrohydraulic servoactuators using active standby redundancy was successfully demonstrated. In particular the stability and predictability of a properly designed hydromechanical failure detector was demonstrated. Author

N73-16516*# Philco-Ford Corp., Palo Alto, Calif. Western Development Lab. Div.
IMPROVEMENT OF SCREENING METHODS FOR SILICON PLANAR SEMICONDUCTOR DEVICES Final Technical Report
W. M. Berger Sep. 1972 209 p refs
(Contract NAS12-2197)
(NASA-CR-124036) Avail: NTIS HC $12.50 CSCL 14D

The results of the program for the development of a more sensitive method for selecting silicon planar semiconductor devices for long life applications are reported. The manufacturing technologies (MOS and Bipolar) are discussed along with the screening procedures developed as a result of the tests and evaluations, and the effectiveness of the MOS and Bilayer screening procedures are evaluated. F.O.S.

N73-16517# Forsvarets Teletekniska Lab., Stockholm (Sweden).
INVESTIGATIONS INTO RELIABILITY DIRECTED ON MATERIAL TECHNICAL METHODS [TILL-FOERLITLIGHETSFORSKNING MED INRIKTNING PA MATERIALTEKNISKA METODER]
O. Bjoerklund and H. Broberg Feb. 1971 28 p refs In SWEDISH
(FTL-A-a16-1) Avail: NTIS HC $3.50

Reliability technique has become a science of rapidly growing significance. Discussed is the field of reliability which deals with the effects of the environment and loading conditions on components, as well as on functioning confidence. Author

N73-16518*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUASI-ONE-DIMENSIONAL COMPRESSIBLE FLOW ACROSS FACE SEALS AND NARROW SLOTS. 2: COMPUTER PROGRAM
John Zuk and Patricia J. Smith Washington Aug. 1972 99 p refs
(NASA-TN-D-6787; E-6305) Avail: NTIS HC $3.00 CSCL 11A

A computer program is presented for compressible fluid flow with friction across face seals and through narrow slots. The computer program carries out a quasi-one-dimensional flow analysis which is valid for laminar and turbulent flows under both subsonic and choked flow conditions for parallel surfaces. The program is written in FORTRAN IV. The input and output variables are in either the International System of Units (SI) or the U.S. customary system. Author

N73-16519*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
EVALUATION OF TANTALUM 316 STAINLESS STEEL TRANSITION JOINTS
D. R. Stoner Dec. 1972 101 p refs
(Contract NAS3-13444)
(NASA-CR-121111; WANL-M-FR-72-006) Avail: NTIS HC $7.25 CSCL 13E

Tubular transition joints providing a metallurgically bonded connection between tantalum and 316 stainless steel pipe sections were comparatively evaluated for durability under thermal cycling conditions approximating the operation of a SNAP-8 mercury boiler. Both coextruded and vacuum brazed transition joints of 50mm (2 inch) diameter were tested by thermal cycling 100 times between 730 C and 120 C(1350 F and 250 F) in a high vacuum environment. The twelve evaluated transition joints survived the full test sequence without developing leaks, although liquid penetrant bond line indications eventually developed in all specimens. The brazed transition joints exhibited the best dimensional stability and bond line durability. Author

N73-16520*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN IMPROVED DIFFUSION WELDING TECHNIQUE FOR TD-NiCr
Kenneth H. Holko Washington Feb. 1973 24 p refs
(NASA-TN-D-7153; E-7190) Avail: NTIS HC $3.00 CSCL 13H

An improved diffusion welding technique has been developed for TD-NiCr sheet. In the most preferred form, the improved technique consists of diffusion welding 320-grit sanded plus chemically polished surfaces of unrecrystallized TD-NiCr at 760 C under 140 MN/m2 pressure for 1hr followed by postheating at 1180 C for 2hr. Compared to previous work, this improved technique has the advantages of shorter welding time, lower welding temperature, lower welding pressure, and a simpler and more reproducible surface preparation procedure. Weldments were made that had parent-metal creep-rupture shear strength at 1100 C. Author

N73-16521*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFLUENCE OF LIQUID LUBRICANT PROPERTIES ON THEIR PERFORMANCE
Vern Wedeven [1972] 30 p refs Presented at the Lubrication Properties Seminar, New York, 12 Oct. 1972, sponsored by the Am. Soc. of Lubrication Engr.
(NASA-TM-X-68183; E-7151) Avail: NTIS HC $3.50 CSCL 11H

The influence of lubricant properties on performance is considered in connection with various mechanisms of lubrication. The effects of temperature and pressure on viscosity, which is important in hydrodynamic and elastohydrodynamic lubrication, is presented using a correlation postulated by Roelands. Under elastohydrodynamic conditions it is important to distinguish between the influence of lubricant properties within the inlet region and the Hertz region since each performs different functions. The role of lubricant transport properties such as surface tension is considered in connection with lubricant starvation. Since the lubrication of practical surfaces usually involves boundary as well as hydrodynamic mechanisms, both the chemical and physical properties significantly influence the lubricant's performance. Author

N73-16522*# Northwestern Univ., Evanston, Ill.
EFFECT OF SURFACE ASPERITY ON ELASTOHYDRODYNAMIC LUBRICATION
Kwan Lee and H. S. Cheng Washington NASA Feb. 1973 76 p refs
(Grant NGL-14-007-084)
(NASA-CR-2195) Avail: NTIS HC $3.00 CSCL 11H

The important aspects of elastohydrodynamic lubrication, with a single, one-dimensional asperity, have been found by solving numerically the coupled transient Reynolds equation and the elasticity equation. Even though the assumption of a single asperity is highly ideal, this study sheds some light on the effect of surface roughness on elastohydrodynamic lubrication. The results show that the film pressure tends to increase more than the steady state pressure, and in particular, the increase in pressure reaches a maximum as the asperity approaches the inlet of the contact region. The asperity height and the pressure increase above the steady state pressure are closely related to each other; the higher the asperity height, the larger the pressure increase. In the pure rolling case, it has been found that a local pressure peak is not developed. However, in the cases of sliding and rolling, a small, local pressure peak is developed on the pressure profile when the asperity moves into the contact region. In general, the overall film thickness profile increases with increasing asperity height, but is not significantly affected by the asperity width. Moreover, the slope of the overall film thickness profile for the transient cases is much greater than the steady state profile, which is approximately constant across the contact width. The increase in the center film thickness also depends upon the width and height of the asperity. Author

N73-16523*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFLUENCE OF VARIOUS SURFACE PRETREATMENTS ON ADHERENCE OF SPUTTERED MOLYBDENUM DISULFIDE TO SILVER, GOLD, COPPER, AND BRONZE
Talivaldis Spalvins Washington Feb. 1973 19 p refs
(NASA-TN-D-7169; E-7062) Avail: NTIS HC $3.00 CSCL 13H

Solid film lubricants of radio frequency sputtered molybdenum disulfide (MoS2) were applied to silver, gold, copper, and bronze surfaces that had various pretreatments (mechanical polishing, sputter etching, oxidation, and sulfurization). Optical and electron transmission micrographs and electron diffraction patterns were used to interpret the film formation characteristics and to evaluate the sputtering conditions in regard to the film and substrate compatibility. Sputtered MoS2 films flaked and peeled on silver, copper, and bronze surfaces except when the surfaces had been specially oxidized. The flaking and peeling was a result of sulfide compound formation and the corresponding grain growth of the sulfide film. Sputtered MoS2 films showed no peeling and flaking on gold surfaces regardless of surface pretreatment. Author

N73-16524*# Pratt and Whitney Aircraft, East Hartford, Conn.
LABYRINTH SEAL TESTING FOR LIFT FAN ENGINES
L. J. Dobek Feb. 1973 78 p refs
(Contract NAS3-14409)
(NASA-CR-121131; PWA-TM-4593) Avail: NTIS HC $6.00 CSCL 11A

An abradable buffered labyrinth seal for the control of turbine gas path leakage in a tip-turbine driven lift fan was designed, tested, and analyzed. The seal configuration was not designed to operate in any specific location but was sized to be evaluated in an existing test rig. The final sealing diameter selected was 28 inches. Results of testing indicate that the flow equations predicted seal air flows consistent with measured values. Excellent sealing characteristics of the abradable coating on the stator land were demonstrated when a substantial seal penetration of .030 inch into the land surface was encountered without appreciable wear on the labyrinth knife edges. Author

N73-16525# Oak Ridge National Lab., Tenn.
BEHAVIOR OF WELDED JOINTS IN STAINLESS AND ALLOY STEELS AT ELEVATED TEMPERATURES
R. G. Gilliland Aug. 1972 62 p refs
(Contract W-7405-eng-26)
(ORNL-4781) Avail: NTIS

An extensive survey was conducted of the available literature concerning the mechanical properties of weldments in Types 304 and 316 stainless steel and in 2 1/4 Cr-1 Mo low-alloy steel. The temperature range of interest was 900 to 1300 F. Data on weldments in these materials were found to be sparse, especially for the case of 304 stainless steel. This situation was especially true, for all materials, in the case of cyclic data (fatigue, etc.). Comparisons of weld-metal/base-metal properties and property variations between filler metals are presented. These data are evaluated with regard to service and fabrication application and experience, and the effect of service-oriented microstructural changes on component integrity is discussed. Finally, recommendations are presented as to additional data and investigations needed to more fully understand the behavior of welded joints in stainless and alloy steels at elevated temperatures. Author (NSA)

N73-16526# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.
SEPARATION OF AEROSOL PARTICLES ACCORDING TO SIZE USING A NEW IMPACTOR JET [ZUR ABSCHEIDUNG VON AEROSOLTEILCHEN NACH IHRER GROESSE MITTILS EINER NEUARTIGEN IMPAKTORDUESE]
D. Hochrainer Bonn Bundeswehramt 1972 30 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-72-11) Avail: NTIS HC $3.50; Bundeswehramt 25 DM

A jet impactor is described, which separates aerosol particles according to size (aerodynamic diameter). A central flow of clean air forms a shielding flow over the impactor surface. The aerosol particles, contained in a layer adjacent to the clean air, are carried outward by the flow as they approach the impact surface, and are thus separated. A simplified theoretical model based on stagnation point flow indicates that a useful resolution could be achieved for a limited range of particle radii. The impactor was built and tested for size separation capability. It was found that size separation can be achieved in the range 0.5 to 2 micrometer diameters, but resolution was not as high as expected by theory. Author (ESRO)

N73-16527# Watervliet Arsenal, N.Y.
FRACTURE DURING AND SUBSEQUENT TO COLD HYDROSTATIC EXTRUSION RESULTING FROM INHOMOGENEOUS PLASTIC DEFORMATION
Joseph Pepe Jun. 1972 48 p refs
(AD-751739; WVT-7217) Avail: NTIS CSCL 13/8

The objective of this investigation is to present some recent findings concerning hydrostatic cold extrusion which may shed considerable insight into the metallurgical and mechanical factors phenomenon during and subsequent to cold deformation. GRA

N73-16528# Ampex Corp., Redwood City, Calif. Corporate Research Dept.
FOIL BEARING INVESTIGATION. REDUCTION OF AIR FILMS IN MAGNETIC RECORDING BY EXTERNAL AIR PRESSURE
A. Eshel 30 Aug. 1972 24 p refs
(Contract N00014-71-C-0001; NR Proj. 062-297)
(AD-751642; RR-72-20) Avail: NTIS CSCL 13/9

The effect of external pressure exerted on foil bearings is studied. Analysis and numerical results are provided for its influence on the bearing gap. It is shown that a substantial reduction in film thickness can be achieved by applying small pressures in the inlet zone. The effect of several pertinent parameters is presented and discussed. Author (GRA)

N73-16529# New Mexico Univ., Albuquerque. Dept. of Mathematics and Statistics.
ESTIMATION OF ACCELERATION AND AGEING FUNCTIONS
W. J. Zimmer and G. P. Steck (Sandia Labs., Albuquerque, N. Mex.) Nov. 1972 18 p refs Sponsored in part by AEC
(Contract N00014-68-A-0155-0003; NR Proj. 042-304)
(AD-751616; TR-264) Avail: NTIS CSCL 14/4

Problems in the areas of accelerated life testing and the prediction of future reliability of ageing components are ones in which the authors wish to relate behavior under one set of conditions to behavior under another set of conditions. Often the interest in relating these behaviors is to predict behavior under one set of conditions using data obtained under the other set. In order to make these predictions various assumptions on the function relating the behaviors (call it the acceleration function or ageing function where appropriate) and the distributions involved have been made. In the paper the authors emphasize the study of the acceleration function itself, provide estimates and confidence intervals assuming only continuity and monotonicity and present a solution to a prediction problem using our estimate of the acceleration function. Author (GRA)

N73-16530# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
PHYSICAL BASIS OF ADHESION Final Report
E. Orowan, M. E. Doyle, A. Maranci, and S. T. Stork Sep. 1972 15 p refs
(Contract F44620-67-C-0060; AF Proj. 9782)
(AD-751301; AFOSR-72-2039TR) Avail: NTIS CSCL 11/1

Research was conducted on the physics of the adhesive joint. The first problems investigated concerned the nature of the bond responsible for adhesion and the role of surface energy, wetting and surface tension. The origin of the high joint strength obtainable with brittle adhesives was explored. A mechanism for interrupting the propagation of cracks within the adhesive was sought. Author (GRA)

N73-16531# Ampex Corp., Redwood City, Calif. Corporate Research Dept.
FOIL BEARING INVESTIGATION: DYNAMIC ANALYSIS OF EXTERNALLY PRESSURIZED FOIL BEARINGS

A. Eshel 30 Aug. 1972 35 p refs
(Contract N00014-71-C-0001; NR Proj. 062-297)
(AD-751604; RR-72-21) Avail: NTIS CSCL 13/9

Analysis of the dynamic behavior of externally pressurized foil bearings is presented. From it, responses to arbitrary disturbances or initial conditions may be deduced. Graphical results for the film response to step reduction in tension and to a moving pressurization source are shown. Author (GRA)

N73-16532# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
EXPERIMENTAL STUDY AND ANALOG SIMULATION OF A JET INTERACTION TYPE PROPORTIONAL FLUID AMPLIFIER
Shiraz Y. Rehmani and James P. Ries Jul. 1972 72 p refs
(Contract N00014-69-A-0417)
(AD-751458; THEMIS-LU-TR-12) Avail: NTIS CSCL 13/7

An analytical and experimental study was conducted for predicting the steady state and dynamic response of a jet interaction proportional fluid amplifier. The analysis is based on a physical model using a lumped parameter approach. The dynamics of the control and receiver lines together with various interacting fluid phenomena occurring within the amplifier are examined. Flow resistances are determined experimentally and the resulting values used in the analytical model. The dynamic model is presented in an analog format suitable for simulation on a digital computer. Author (GRA)

N73-16533# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF CASTING CONDITIONS ON THE QUALITY OF THE ROLLING SURFACE OF BALL BEARING STEEL
G. Kh. Gabuev, V. A. Efimov, A. I. Khitrik, R. D. Minizon, V. I. Travinin, Ye. N. Lefremova, and V. P. Osipov 15 Sep. 1972 12 p Transl. into ENGLISH from the publ. "Problemy Stalnogo Slitka" Moscow, Izd-vo Metallurgiya, 1969 p 403-407
(AD-751252; FTD-MT-24-730-72) Avail: NTIS CSCL 13/8

A considerable part of the ball bearing steel at the Dneprospetsstal plant was damaged by surface defects, which leads to rejection and great losses due to restripping of the rolled product and smaller dimensions. In so doing, surface flaws for the most part take place on metal rolled from hot loaded ingots; billets rolled from cold loaded ingots or with the considerable delay in hot loading, have, as a rule, the best surface. Primarily this pertains to metal teemed under a slag of exothermic compounds. In connection with this, a study was made of the effect of the conditions of teeming on the surface condition of the ingots and the rolling. Cast metal was investigated on hollow shells of ingots obtained by the method of pouring out the liquid residue on two melts. In so doing, ingot 1 was obtained with teeming into a casting mold lubricated with Kuzbas varnish, and ingot 2 - with the use of exothermic compounds. GRA

N73-16534# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIENCE IN THE COLD EXTRUSION OF STEEL WORKPIECES USING A NUTATING DIE
Zdzislaw Marciniak and Andrez Chodakowski 28 Sep. 1972 14 p refs Transl. into ENGLISH from Stahl und Eisen (West Germany), no. 20, 1970 p 1077-1080
(AD-751146; FTD-HT-23-1581-71) Avail: NTIS CSCL 13/8

Cold extruding requires presses with a high compressive force. The reshaping force can be considerably reduced when the upper die which is used for extruding parts touches only small contact surfaces in comparison to the total extruding surface. By means of rotating or pendulum movements of the upper die, workpieces can be reshaped in spite of the smaller contact surface over its entire cross section in connection with which considerably lower reshaping forces are required than previously. An extruding machine with tumbling dies is described which enables parts having complicated shapes having a high degree of mass and precision surfaces to be cold shaped. GRA

N73-16535# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
QUESTION OF THE INFLUENCE OF THE INCLINATION ANGLE OF GROOVES ON THE BEARING CAPACITY OF A GAS DYNAMIC THRUST BEARING WITH A HERRING BONE RELIEF
V. N. Drozdovich, V. V. Ivanova, and G. Ya. Yunusov 8 Aug. 1972 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Priborostr. (Leningrad), no. 1, 1971 p 94-98
(FTD Proj. 304806)
(AD-751068; FTD-HT-23-531-72) Avail: NTIS CSCL 13/9

The influence of supporting surface relief shape of a slide bearing on its bearing capacity was studied. Analysis was made on the basis of the Reynolds PH-linearized equation. Recommendations are made for the selection of an inclination angle for herring bone grooves with a sinusoidal profile. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-16536* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LASER COMMUNICATION SYSTEM FOR CONTROLLING SEVERAL FUNCTIONS AT A LOCATION REMOTE TO THE LASER Patent
Ernest E. Burcher, Carroll W. Rowland, and Archibald R. Sinclair, inventors (to NASA) Issued 9 Jan. 1973 6 p Filed 24 Apr. 1970 Supersedes N70-35542 (08 - 19, p 3552)
(NASA-Case-LAR-10311-1; US-Patent-3,710,122; US-Patent-Appl-SN-31702; US-Patent-Class-250-199; US-Patent-Class-340-171; US-Patent-Class-350-293) Avail: US Patent Office CSCL 20E

A multichannel laser remote control system is described. The system is used in areas where radio frequency, acoustic, and hardware control systems are unsatisfactory or prohibited and where line of sight is unobstructed. A modulated continuous wave helium-neon laser is used as the transmitter and a 360 degree light collector serves as the antenna at the receiver. Official Gazette of the U.S. Patent Office

N73-16537# Bureau of Mines, Denver, Colo. Mining Research Center.
PHASE-CONTRAST ENHANCEMENT WITHOUT SPATIAL FILTERS FOR SEISMIC HOLOGRAPHY
G. L. Fitzpatrick 1973 20 p refs
(BM-RI-7721) Avail: NTIS HC $3.00

The development of phase contrast enhancement techniques for seismic holography without the use of spatial filters is discussed. Results similar to those obtained with spatial filters may be obtained without filters by specially processing the seismic hologram data. The details of the process are explained. The technique is experimentally verified by examining computer generated synthetic seismic holograms rather than by examining actual seismic field data. Author

N73-16538*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EQUATIONS FOR THE KINETIC MODELING OF SUPERSONICALLY FLOWING ELECTRICALLY EXCITED LASERS
Richard C. Lind Jan. 1973 29 p refs Sponsored in part by NAS-NRC
(NASA-TM-X-62196) Avail: NTIS HC $3.50 CSCL 20E

The equations for the kinetic modeling of a supersonically flowing electrically excited laser system are presented. The work focuses on the use of diatomic gases, in particular carbon monoxide mixtures. The equations presented include the vibrational rate equation which describes the vibrational population distribution, the electron, ion and electronic level rate equations, the gasdynamic equations for an ionized gas in the presence of an applied electric field, and the free electron Boltzmann equation including flow and gradient coupling terms. The model developed accounts for vibration-vibration collisions, vibration-translation collisions, electron-molecule inelastic excitation and superelastic de-excitation collisions, charge particle collisions, ionization and three body recombination collisions, elastic collisions, and radiative decay, all of which take place in such a system. A simplified form of the free electron Boltzmann equation is developed and discussed with emphasis placed on its coupling

with the supersonic flow. A brief description of a possible solution procedure for the set of coupled equations is then discussed.
Author

N73-16539# Central Research Inst. for Physics, Budapest (Hungary).
MEASUREMENT OF MODE-LOCKED ULTRASHORT LASER PULSES BY DIFFERENT ORDER PHOTOELECTRIC EFFECTS
Gy. Farkas, Z. Gy. Horvath, and I. Kertesz 1972 11 p refs
(KFKI-72-41) Avail: AEC Depository Libraries

A simple experimental method for the determination of the duration and intensity of ultrashort pulses is given. The method consists of simultaneous oscilloscopic observation of current signals induced by linear and nonlinear photoelectric effects which are detected using a linear and a nonlinear photocell and two oscilloscopes. Author

N73-16540# California Univ., Livermore. Lawrence Livermore Lab.
SMALL DISPLACEMENT MEASUREMENTS USING HOLOGRAPHIC INTERFEROMETRY
Michael J. Burger 13 Jun. 1972 18 p refs
(Contract W-7405-eng-48)
(UCRL-51241) Avail: NTIS

Holographic interferometry produced by coherent laser light can be used to detect three-dimensional displacements as small as 12 microinches on a complex curved surface deformed by either stresses or temperature gradients and displacements caused by solid-body motion. With this technique, the measuring apparatus is independent of the surface being measured which is an advantage over strain gage or photoelasticity techniques. A computer code was developed to give quantitative and qualitative interpretation in the form of displacement contour lines. Author (NSA)

N73-16541# California Univ., Livermore. Lawrence Livermore Lab.
LLL LASER PROJECTS REPORT NO. 1
George I. Kachen, ed. and Gary Shaw, ed. May 1972 41 p refs
(Contract W-7405-Eng-48)
(UCRL-50022-1) Avail: NTIS

Nine reprints from other LRL reports are included. They are: (1) laser-produced plasmas for X-ray studies, (2) double-discharge CO2 laser, (3) plasma production with LLL's long-path Nd-glass disk laser, (4) mode-locked CO2 laser with single-pulse selection: and (5) ultrafast streaking camera for laser diagnostics, (6) theory and kinetics of HF lasers, (7) experiments with HF chemical lasers, (8) short-pulse HF oscillator, and (9) short-pulse, solid-state oscillators. NSA

N73-16542# California Univ., Livermore. Lawrence Livermore Lab.
USE OF GRATING TO INCREASE RECORDING CAPABILITY OF LASER FAR FIELD CAMERA
H. Joseph Weaver, Jr. 26 Jul. 1972 7 p
(Contract W-7405-eng-48)
(UCRL-51255) Avail: NTIS

It is shown that by placing a grating of line width 2a and spacing T before the lens of a laser far field camera, one is able to obtain the original far field pattern repeated periodically.
Author

N73-16543# Maryland Univ., College Park. Dept. of Electrical Engineering.
OPTICAL COMMUNICATION SYSTEMS
Robert O. Harger and John R. Whinnery 28 Jan. 1972 42 p refs Workshop held at College Park, Md., 27-28 Jan. 1972
(Grant NSF GK-32172)
(PB-212692) Avail: NTIS HC $3.00 CSCL 17B

Research areas where universities may make contributions to the communication system possibilities of the laser are discussed. The laser, with its efficiency, fidelity, capacity, and spectrum availability is the highlight of optical communications and engineering optics. Guidelines for NSF grant subjects were tentatively established. Problem areas that presently limit the laser's usage include: quantum communication theory, turbulent atmospheric channel, materials, broad bandwidth modulators and detectors, auxiliaries. Also discussed were the novel aspects of optical communication systems that theory must examine to correctly determine fundamental limitations with respect to quantum and spatial phenomena. Author (GRA)

N73-16544# United Aircraft Corp., East Hartford, Conn. Research Labs.
ACOUSTIC-OPTIC MODULATOR DESIGN FOR A HIGH POWER MODE-LOCKED CO2 LASER Interim Report
J. Flynn and Paul J. Berger 1 Nov. 1972 27 p refs
(Contract N00014-69-C-0308; NR Proj. 016-204)
(AD-751680; L920832-5) Avail: NTIS CSCL 20/5

The report describes the design considerations and construction details involved in the development of a Brewster angle germanium acousto-optic modulator, having a 6 mm square aperture. This modulator was used to mode-lock an electrically pulsed transversely excited atmospheric (TEA) CO2 laser at an axial-mode frequency of 44 MHz. The power insertion loss was measured to be 50 percent and the modulator withstood peak intracavity intensities in excess of 6 MW/sq. cm. (.2 microsecond pulse) and 160 MW/sq. cm. (1 nsec pulse) without damage, representing significant improvements over the performance of anti-reflection coated modulators. After correcting for the risetime of the display system, the mode-locked pulses are estimated to have a pulsewidth of 1.2 nsec and a peak power of 20 megawatts. Author (GRA)

N73-16545# Naval Postgraduate School, Monterey, Calif.
PULSED GAIN MEASUREMENTS ON CO2 LASERS M.S. Thesis
Timothy Lee Houck Jun. 1972 53 p refs
(AD-751620) Avail: NTIS CSCL 20/5

An efficient procedure for determining the operational potential of a laser system is the experimental measurement of gain. Two laser systems, a flowing CO2-N2-He laser and a chemical CO2-HN3 laser, were studied using a pulsed gain measurement technique. The experimental investigation indicated that the flowing CO2-N2-He laser system could produce lasing action and that the saturation parameter was 15 watts/sq. cm. The experimental results for the chemical laser show a gain of approximately 8% per meter and agree qualitatively with a computer model of the CO2-HN3 laser. Author (GRA)

N73-16546# Naval Postgraduate School, Monterey, Calif.
THE HN3 PLUS CO2 LASER: AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION M.S. Thesis
F. K. Helmsin Mar. 1972 79 p refs
(AD-751634) Avail: NTIS CSCL 20/5

A detailed description of the reaction mechanisms involved in the HN3 - CO2 laser is presented. The explosive decomposition of HN3 and the resulting laser gain have been analytically modeled to gain an insight into the potential of the laser. In addition, an experimental investigation has been conducted in order to determine the existence of laser action and applicability of the model. GRA

N73-16547# Washington Univ., Seattle. Aerospace Research Lab.
CHEMICAL KINETICS AND FLUID MECHANICAL ASPECTS OF GAS LASERS Final Summary Report, Apr. 1969 - May 1972
May 1972 16 p refs
(Contract N00014-67-A-0103-0008)
(AD-751694) Avail: NTIS CSCL 20/5

The effect of reducing the ratio of CO2 to N2 was primarily studied. A program of measurement of gain in expanding CO2 laser mixtures at high pressure was carried out. Improved energy storage capability was successfully demonstrated through small signal gain measurements taken in a shock tube. This experimental approach allows the measurement of gain with various mixture ratios over a wide range of pressure conditions. GRA

N73-16548# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE RANGE OF VIDEO TRANSMISSION IN WATER BY LASER BEAM
G. I. Vlasov and I. M. Levin 25 Aug. 1972 10 p Transl. into ENGLISH from the book "Probl. Peredachi Inform." 1969 p 650-655

(AF Proj. 1256)
(AD-751445; FTD-HC-23-0847-72) Avail: NTIS CSCL 17/2

The range of video transmission in water by laser is discussed. A communications system consisting of an optical laser emitting a narrow light beam and a receiver consisting of lens and photoreceiver is examined. Author (GRA)

N73-16549# ARO, Inc., Arnold Air Force Station, Tenn.
THE CONCEPT OF A PERFECTLY STIRRED REACTOR AS A CHEMICAL LASER DEVICE Final Report, 21 Sep. 1971 - 29 Feb. 1972
I. T. Osgerby AEDC Nov. 1972 67 p refs
(Contract F40600-73-C-0004)
(AD-751299; ARO-ETF-TR-72-67; AEDC-TR-72-127) Avail: NTIS CSCL 20/5

An analytical study of a chemical laser system based on the concept of a stirred reactor cavity is described. The stirred reactor concept is well established in fuel combustion studies as a device which provides steady-state spatially uniform reaction products in a wide degree of nonequilibrium. Because of the uniform distribution of emitters, a stirred reactor laser cavity should have inherently better beam quality than mixing/reacting nozzle flow devices; however, it remains to be established if a stirred reactor cavity is feasible in practice. Numerical results are presented with coupled chemical kinetic-radiative depopulation rates which show that significant power levels are possible. Results for small signal gain (no power) are also presented. The numerical technique enables prescribed cavity radiation flux densities from zero to infinity to be used. A marked sensitivity to collisional deactivation (relaxation) rates was determined numerically, with predicted power levels attainable dependent primarily on these rates. Author (GRA)

N73-16550# Naval Research Lab., Washington, D.C. Laser Physics Branch.
PARALLEL PLATE TRANSMISSION LINE POCKELS CELL Final Report
J. P. Letellier 12 Oct. 1972 21 p refs
(ARPA Order 2062)
(AD-751532; NRL-7463) Avail: NTIS CSCL 20/5

Design details were worked out for the construction of a KD*P Pockels cell capable of splitting out one or more pulses with a contrast ratio of 1000:1 or better from a Nd:YAG mode-locked pulse train. In addition, the two-port stripline construction of this Pockels cell makes possible the accurate sequential opening of two or more Pockels cell shutters from the same electrical signal. Author (GRA)

N73-16551# Ohio State Univ., Columbus. Electroscience Lab.
INVESTIGATION OF LASER PROPAGATION PHENOMENA Quarterly Technical Report
Stuart A. Collins, Jr., Edward K. Damon, and Raymond P. Urtz, Jr. Griffiss AFB, N. Y. RADC Aug. 1972 22 p
(Contract F30602-72-C-0305; ARPA Order 1279)
(AD-751304; ESL-3432-1; RADC-TR-72-247) Avail: NTIS CSCL 20/5

The document is the first quarterly technical report under the contract. Work during the quarter was concentrated on temporal spectra of phase difference fluctuations of atmospherically degraded spherical waves and on averaging times of optical random data. The temporal spectra derivation considered the case of a horizontal wind transverse to the optical path but with the phase measurement points oriented so that their separation vector makes an arbitrary angle with the horizontal. The spectra also included outer scale effects. The averaging time discussion outlined a technique for determining the averaging time of random data while the data is being recorded but in a time much shorter than the total data duration. Author (GRA)

N73-16552# Case Western Reserve Univ., Cleveland, Ohio. Div. of Electrical Sciences and Applied Physics.
FAR INFRARED ISOLATOR Final Report, 15 May 1971 - 15 May 1972
Yoh-Han Pao and W. T. Boord 31 Jul. 1972 46 p refs
(Contract F19628-71-C-0194; AF Proj. 3326)
(AD-751319; AFCRL-72-0444) Avail: NTIS CSCL 20/5

It has been determined that optical isolators for linearly polarized (laser) beams of moderate power may be constructed with n-type InSb as the active element. The effect used in the device is the difference between the large free electron Faraday effect and the somewhat smaller interband Faraday effect. Somewhat unexpectedly, the authors find that the magnitude of the Faraday effect varies greatly with crystal orientation and absorption coefficients differ with suppliers of the crystals. In a typical device, the InSb wafer is about 0.38 mm thick, is maintained at liquid nitrogen temperature, has a donor (Te) concentration of about 3 x 10 to the 17th power/cc and provides 45 degrees rotation in a field of about 3500 Gauss. The dissipated power is less than 20% of the incident and there is no danger of thermal runaway for power densities up to 500 watts/sq cm. The quality of the isolation depends primarily on the quality of the analyzers used. Author (GRA)

N73-16553# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
LASER INDUCED DAMAGE TO MIRRORS AT TWO PULSE DURATIONS Technical Report, 31 Dec. 1971 - 30 Jun. 1972
E. S. Bliss, D. Milam, and R. A. Bradbury 25 Jul. 1972 39 p refs
(ARPA Order 1434; AF Proj. 6100)
(AD-751265; AFCRL-72-0423; AFCRL-PSRP-504; TR-2) Avail: NTIS CSCL 20/5

The damage thresholds of eight, multiple layer dielectric, 95 percent reflecting mirrors have been measured for single pulses of 20 nsec and 20 psec duration. In both sets of measurements the pulse energy, an oscilloscope trace of the pulse, and the beam's transverse energy density profile at the surface being damaged are recorded for each shot. The variation of the threshold from mirror to mirror and as a function of pulse duration, beam radius, and appearance under microscopic examination is discussed in the context of possible damage mechanisms. Author (GRA)

N73-16554# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Solid State Sciences Lab.
THEORY OF ON-AXIS INTENSITY DISTRIBUTION IN THERMAL LENSING (LQ-10 HIGH POWER LASER WINDOW PROGRAM)
Bernard Bendow and Peter D. Gianino 24 May 1972 78 p refs
(AF Proj. 3326)
(AD-751266; AFCRL-72-0322; PSRP-494) Avail: NTIS CSCL 20/5

As part of its over-all program in the identification, preparation, and application of materials for use as high-power infrared laser windows, AFCRL has investigated theoretically and experimentally the thermal lensing caused by the distortion and defocusing of a laser beam traversing a material medium. In the report, the vector Kirchhoff approximation is applied to obtain the diffraction field due to a nonuniform laser beam normally incident on an optically isotropic, annular-shaped solid lens. Detailed computations of the on-axis intensity distribution versus time in both abstract and real variables are presented for Gaussian beams incident on various transmitting materials at 10.6 micrometers. The results of the computations demonstrate the role played by induced thermal stresses, incident beam shape, refocused beam, center-chopped beam, the mating of two compensating materials. Two rough figures of merit are given for rating any window's optical and mechanical-optical performance. It is shown how lensing depends on material parameters. Author (GRA)

N73-16555# Naval Training Device Center, Orlando, Fla.
LASER SAFETY IN PULSED HOLOGRAPHY
Denis R. Breglia, Windell N. Mohon, and Alfred H. Rodemann May 1972 26 p refs
(NTDC Proj. 1716-06)
(AD-751024; NAVTRADEVCEN-TN-17) Avail: NTIS CSCL 20/5

The report is a comprehensive review of the basic laser safety procedures to be employed when using a pulsed laser. The laser presently being used at this laboratory is discussed as one particular example. The safe exposure levels for pulsed lasers are discussed in radiometric terms. The radiometry of sources and surfaces is discussed. Practical calculations are given. A

safety analysis is given of the direct beam, diffuse sources, and viewing with magnifying optics. The safety procedures to be employed when making pulsed holograms of people are outlined. The conservation of radiance theorem is derived and discussed.
Author (GRA)

N73-16556# Ohio State Univ., Columbus. ElectroScience Lab.
INFRARED LINE SHAPE STUDY USING A TUNABLE 2.01 MICRON He-Xe LASER Final Report
R. K. Long and F. S. Mills Apr. 1972 33 p refs
(Contract DAAG05-69-C-0782)
(AD-751230; ESL-2834-2) Avail: NTIS CSCL 07/4

A tunable laser spectroscopy experiment using a magnetically tuned He-Xe laser at 2.02 micrometers is described. CO2 absorption spectra were measured over a 0.18/cm band near the laser frequency. A laser line width of less than 0.00067/cm was achieved. Line widths of CO2 were measured in the near Doppler pressure region (0.5 to 3.0 torr) and excellent agreement with Voight profile theory was achieved. Author (GRA)

N73-16557# ILC, Inc., Sunnyvale, Calif.
OPTICAL PUMPS FOR LASERS Triannual Report, no. 2, 17 Sep. 1971 - 16 Mar. 1972
Lowell Noble and Carl Kretschamer Aug. 1972 71 p refs
(Contract DAAB07-71-C-0239; DA Proj. 1H6-62705-A-055)
(AD-751212; R-ILC-72-13; ECOM-0939-2) Avail: NTIS CSCL 20/5

The objective of this program is to increase both the efficiency and the reproducibility of optical pumps for pulsed Nd:YAG lasers. This report covers work carried out from 17 September 1971 to 16 March 1972. Xenon lamps with cerium-doped quartz envelopes were tested and were found to provide less useful light output than xenon lamps with normal quartz envelopes; however, lamps with cerium-doped envelopes may be useful because they can help reduce degradation of organic coolants, laser rods, and cavity reflecting surfaces. Surrounding the lamp with a fluorescent dye solution first increased the useful Nd:YAG fluorescent light output but the dye was quickly bleached and rendered ineffective. Preliminary measurements on lamps for pumping holmium lasers indicated that xenon flashlamps are the most suitable for this purpose. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-16558*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
NORMAL EVAPORATION OF BINARY ALLOYS
C. H. Li Nov. 1972 29 p refs
(Contract NAS8-27891)
(NASA-CR-124040; RM-558) Avail: NTIS HC $3.50 CSCL 11F

In the study of normal evaporation, it is assumed that the evaporating alloy is homogeneous, that the vapor is instantly removed, and that the alloy follows Raoult's law. The differential equation of normal evaporation relating the evaporating time to the final solute concentration is given and solved for several important special cases. Uses of the derived equations are exemplified with a Ni-Al alloy and some binary iron alloys. The accuracy of the predicted results is checked by analyses of actual experimental data on Fe-Ni and Ni-Cr alloys evaporated at 1600 C, and also on the vacuum purification of beryllium. These analyses suggest that the normal evaporation equations presented here give satisfactory results that are accurate to within an order of magnitude of the correct values, even for some highly concentrated solutions. Limited diffusion and the resultant surface solute depletion or enrichment appear important in the extension of this normal evaporation approach. Author

N73-16559*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF AUTOCLAVE HEAT TREATMENTS ON THE MECHANICAL PROPERTIES OF THE PREALLOYED POWDER COBALT-BASE ALLOY HS-31
John C. Freche and Richard L. Ashbrook Washington Feb. 1973 24 p refs
(NASA-TN-D-7117; E-7107) Avail: NTIS HC $3.00 CSCL 11F

The cobalt-base alloy HS-31 was atomized into powder and then consolidated by extrusion or by hot isostatic pressing (HIP) in an autoclave over a range of temperatures spanning the solidus, approximately 2340 F. Extrusions were subsequently autoclaved at the same conditions. Extrusions autoclaved at 2420 F had a life of 300 hours at 1200 F and 30 hours at 1800 F at stresses that result in a 10-hour life with cast HS-31. Superior stress rupture lives of autoclaved material are probably related to the solidification structure at the grain boundaries as well as to the increased grain size. Author

N73-16560# Bureau of Mines, Reno, Nev. Metallurgy Research Center.
MOLTEN SALT ELECTROWINNING OF MAGNESIUM-YTTRIUM ALLOYS
E. Aamland, D. J. MacDonald, and D. G. Kesterke 1973 14 p refs
(BM-RI-7722; LC622.06173; TN23.U7) Avail: NTIS HC $3.00

Preparation of high-purity magnesium-yttrium alloys by electroreduction of Y2O3 dissolved in a YF3-LiF bath and the subsequent deposition of yttrium in a molten magnesium cathode was investigated in laboratory-scale apparatus. Parameters such as temperature, current density, and electrolyte density were studied. Electrolysis was conducted in a specially designed MgO diaphragm cell at temperatures ranging from 780 to 970 C. Alloys containing up to 55 weight-percent yttrium were prepared at cathode current efficiencies of 21 to 60 percent. Cell design and operation are described, and some of the limiting conditions pertaining to the method are discussed. Author

N73-16561*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
WELDABILITY, STRENGTH, AND HIGH TEMPERATURE STABILITY OF CHEMICALLY VAPOR DEPOSITED TUNGSTEN Final Report, 30 Jun. 1969 - 30 Apr. 1972
W. A. Bryant Dec. 1972 103 p refs
(Contract NAS3-13222)
(NASA-CR-120876; WANL-M-FR-72-007) Avail: NTIS HC $7.25 CSCL 11F

Three types of CVD tungsten (fluoride-produced, chloride-produced and the combination of the two which is termed duplex) were evaluated to determine their weldability, high temperature strength and structural stability during 5000 hour exposure to temperatures of 1540 C and 1700 C. Each type of CVD tungsten could be successfully electron beam welded but the results for the chloride product were not as satisfactory as those of the other two materials. The high temperature strength behavior of the three materials did not differ greatly. However a large difference was noted for the grain growth behavior of the two basic CVD tungsten materials. Fluoride tungsten was found to be relatively stable while for the most part the grain size of chloride tungsten increased appreciably. The examination of freshly fractured surfaces with a scanning electron microscope revealed numerous bubbles in the fluoride material following its exposure to 1700 C for 5000 hours. Less severe thermal treatments produced relatively few bubbles in this material. Only at certain locations within the chloride material associated with the interruption of tungsten were bubbles noted. Author

N73-16562*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DEVELOPMENT OF ADVANCED HIGH STRENGTH TANTALUM BASE ALLOYS. PART 1: SCREENING INVESTIGATION Final Report, Oct. 1967 - 4 Jul. 1970
R. W. Buckman, Jr. Dec. 1971 68 p refs
(Contract NAS3-10939)
(NASA-CR-120818; WANL-PR-71-001-Pt-1) Avail: NTIS HC $5.50 CSCL 11F

Five experimental tantalum alloy compositions containing 13-18% W+Re+Hf solid solution solute additions with dispersed phase strengthening achieved by carbon or nitrogen additions

were prepared as 1.4 inch diameter ingot processed to 3/8 inch diameter rod and evaluated. Elevated temperature tensile and creep strength increased monotonically with increasing solute content. Room temperature elongation decreased for 20% to less than 2% as the solute content was increased above 16%. Phase identification indicated that the precipitating phase in the carbide containing alloys was Ta2C. Author

N73-16563*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
EXAMINATION OF THE INFLUENCE OF COATINGS ON THIN SUPERALLOY SECTIONS
Murray Kaufman Aug. 1972 165 p refs
(Contract NAS3-15557)
(NASA-CR-121115) Avail: NTIS HC $10.25 CSCL 11F

The effects of two coatings, Codep B-1 and CoCrAlY, with and without simulated engine exposures at 982 C (1800 F) and 1093 C (2000 F), were evaluated on cast sections of Rene 80. Section thicknesses were from 0.075 cm (0.030 inch) to 0.15 cm (0.060 inch). Tensile and stress rupture properties, mechanical fatigue, thermal fatigue, ballistic impact and hot corrosion at R. T. and elevated temperatures were investigated. Thin sections generally had pporer tensile strengths and lower stress rupture lives than standard 1/4 inch round gage bars. The coatings, as-applied, had little effect on tensile strengths, rupture lives and mechanical fatigue and they increased thermal fatigue, ballistic impact and hot corrosion resistance. By providing considerable exposure protection to the Rene 80, the coatings improved all properties compared to exposed bare specimens. Author

N73-16564*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVEMENT IN CYCLIC OXIDATION OF THE NICKEL-BASE SUPERALLOY B-1900 BY ADDITION OF ONE PERCENT SILICON
Carl E. Lowell and R. V. Miner 18 Jan. 1973 13 p refs
(NASA-TM-X-68191; E-7323) Avail: NTIS HC $3.00 CSCL 11F

Cast B-1900 with and without 1 weight percent Si was subjected to cyclic oxidation at 1000 and 1100 C in air for 700 and 200 hours, respectively. The results were judged by specific weight change, metallography and X-ray diffraction. Si was found to be of significant value in reducing oxidation attack, probably by increasing scale adherence. Author

N73-16565# British Steel Corp., London (England). Physics Dept.
WEAR AND THE STEEL INDUSTRY
M. M. Wilson Jun. 1972 22 p refs
(PB-211173; BISRA-PH/6/72) Avail: NTIS HC $3.00 CSCL 11F

Plant wear makes a substantial contribution to the running costs incurred by the British Steel Industry. The report describes present thinking on the more common wear processes and possible future improvements in the understanding of wear and then goes on to describe the two possible approaches to reducing wear. The first is to alter the physical conditions under which the wear is taking place, and the second is to replace existing materials by types more resistant to wear. The various types of wear-resistant material available are discussed. These include the recently developed materials with potential to resist wear, and familiar materials which have been modified with marked improvements in their wear performance. The report also outlines the various types of wear experienced in the steel industry and concludes by recommending what action should be taken to reduce expenditure on wear, particularly the research which should be carried out. Author (GRA)

N73-16566# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
PROPERTY-MICROSTRUCTURE RELATIONSHIPS IN TITANIUM ALLOY, Ti-6Al-2Sn-4Zr-6Mo Final Report, Feb. 1969 - Feb. 1971
J. A. Hall, C. M. Pierce, D. L. Ruckle (Pratt and Whitney Aircraft, East Hartford, Conn.), and R. A. Sprague (Pratt and Whitney Aircraft, East Hartford, Conn.) Nov. 1971 48 p refs
(AD-751530; AFML-TR-71-206) Avail: NTIS CSCL 11/6

The tensile properties and fracture toughness levels found in forged and heat treated pancake forgings of the high strength titanium alloy, Ti-6Al-2Sn-4Zr-6Mo, were analyzed as to their relationship to microstructural features. The desired microstructure for the alloy, resulting in an optimum combination of both fracture toughness and tensile ductility at yield strengths of 170-180 ksi, is described as containing about 10 volume percent equiaxed globular alpha (primary alpha) along with a matrix containing relatively coarse acicular alpha (secondary alpha) and aged beta. Author (GRA)

N73-16567# Midwest Research Inst., Kansas City, Mo.
CRYSTALLOGRAPHIC FATIGUE CRACK GROWTH IN ALUMINUM SINGLE CRYSTALS
David K. Benson and G. Gordon Shaw Nov. 1972 16 p refs
(Contract N00014-71-C-0020)
(AD-751603; TR-1) Avail: NTIS CSCL 11/6

Single crystals of aluminum were fatigued in cantilever bending to produce many Stage I (crystallographic) fatigue cracks along parallel (111) slip planes. The average rate of crack growth was measured as a function of the strain-intensity factor in both vacuum and humid air (81% RH). Three-dimensional replicas of Stage I cracks were examined by SEM and found to be very complex in morphology with many small secondary cracks branching from the primary cracks produced in air but not from those produced in vacuum. Environmentally assisted cleavage along these secondary cracking planes is thought to account for their formation in air. The secondary cracks subsequently blunt the stress-intensity at the tip of the primary crack and retard its growth. Author (GRA)

N73-16568# Naval Research Lab., Washington, D.C. Strength of Metals Branch.
SIGNIFICANCE OF CHARPY-5 TEST PARAMETERS AS CRITERIA FOR QUENCHED AND TEMPERED STEELS
P. P. Puzak and E. A. Lange 10 Oct. 1972 22 p refs
(Contract AT(04-3)-863)
(AD-751534; NRL-7483) Avail: NTIS CSCL 11/6

A ductility parameter has been suggested to replace the energy parameter as the criterion of performance of a quenched and tempered steel. The lateral expansion (LE) of the Charpy v specimen has been hypothesized to be a self-adjusting index of fracture resistance to compensate for the wide range in the yield strength of quenched and tempered steels. This hypothesis is examined using information from an extensive bank of data generated at NRL as well as the information in the literature. GRA

N73-16569# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
CORROSION CRACKING OF METALLIC MATERIALS. PART 1: SUMMARY Final Report, 15 Dec. 1968 - 31 Dec. 1971
Mars G. Fontana Wright-Patterson AFB, Ohio AFML Aug. 1972 536 p refs
(Contract F33615-69-C-1258; AF Proj. 7312)
(AD-751544; AFML-TR-72-102-Pt-1) Avail: NTIS CSCL 11/6

Studies on the stress corrosion cracking of titanium and its alloys involved the initiation and propagation of cracks in aqueous and organic environments, combined effects of stress and potential, corrosion processes within crevices, and alloy composition. Straining electrode studies are reported. Author (GRA)

N73-16570# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
CORROSION CRACKING OF METALLIC MATERIALS. PART 2: ACOUSTIC EMISSION: EXPERIMENT AND THEORY
Mars G. Fontana and Karl F. Graff Wright-Patterson AFB, Ohio AFML Aug. 1972 73 p refs
(Contract F33615-69-C-1258; AF Proj. 7312)
(AD-751529; AFML-TR-72-102-Pt-2) Avail: NTIS CSCL 11/6

The aspects of acoustic emission associated with the theory of the stress waves emitted from cracking and the experimental measurement of the acoustic emission pulses is reported. In the theoretical phase of the work, a survey of the applicable literature in the area of stress waves from moving cracks is

reviewed. Certain simple theoretical arguments pertaining to the energy release from an increment of crack growth are reported. In the experimental phase, an evaluation of a number of ultrasonic nondestructive test transducers for acoustic emission work was carried out and an optimum transducer selected. A complete acoustic emission test system was then constructed and several tests performed by the conclusion of the project. Author (GRA)

N73-16571# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EQUATION FOR THE PLASTIC DEFORMATION OF METALS
A. G. Fralkenzon and E. V. Vargasova 30 Aug. 1972 12 p refs Transl. into ENGLISH from Tr. Metrol. Inst. (USSR), no. 100, 1970 p 50-52
(AD-751151; FTD-HT-23-1156-72) Avail: NTIS CSCL 11/6

A new equation is developed for the plastic deformation of metals under tension. It is based on the work of G. P. Zaitseva and S. I. Gubkina. The new equation is of the form: S = SBPSIP(N-1 LOG (1-PSIP) over (0.41 GPSIP) – SB(1-PSIP)-2.5 (N-1), where S = true stress, SB = true uts, PSIP = limiting uniform contraction of the specimen, PSI = flow value of the relative contraction, and N = LOG PSI over LOG PSIP. The formula was verified and found to be adequately precise for Al, Cu, and the steels St3,St5,35,45, and KhVG. GRA

N73-16572# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
STRESS CORROSION CRACKING OF TITANIUM ALLOYS IN METHANOLIC AND OTHER MEDIA Technical Report, Apr. 1969 - Sep. 1970
C. M. Chen (Ohio State Univ., Columbus), H. B. Kirkpatrick, and H. L. Gegel Mar. 1972 66 p refs
(AF Proj. 7353)
(AD-751528; AFML-TR-71-232) Avail: NTIS CSCL 11/6

Results are given of a systematic survey of the stress-corrosion cracking behavior of titanium and certain of its alloys in such environments as pure organic liquids, organic liquid-bromine mixtures, methanol-water-acid mixtures, methanol vapor, and liquid mercury. Stress-corrosion behavior is measured by time-to-failure under static tensile load and by reduction in ultimate elongation under dynamic tension. The effects are described of such variables as water concentration, bromine concentration, applied electrical potential, and strain rate. Author (GRA)

N73-16573# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
Na2SO4 INDUCED ATTACK OF Ni-20Cr-2ThO2
Hubert H. Davis, Jr., Henry C. Graham, and George F. Uhlig Jun. 1972 27 p refs
(AF Proj. 7021)
(AD-751259; ARL-72-0092) Avail: NTIS CSCL 11/6

The Na2SO4-induced oxidation behavior of Ni-20Cr-2ThO2 was studied using thermogravimetric and microstructural techniques. This is of interest in gas turbine corrosion. Specimens were spraycoated with approximately 1 mg/sq cm of Na2SO4, and subsequently exposed to pure oxygen at 150 torr at 900 and 1000C. Continuous gravimetric measurements were carried out to determine oxidation kinetics, and the results have been correlated with microstructural studies. Scale morphologies were characterized by a combination of SEM, microprobe, and optical techniques. The presence of Na2SO4 on the alloy promotes a transient period of accelerated attack during which NiO is the predominant oxide formed on the specimen surface. Chromium sulfide particles precipitate internally in the alloy during the early stages of exposure and remain in the alloy throughout the duration of the experiment. Author (GRA)

N73-16574# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Metallurgy and Ceramics Research Lab.
THE EFFECT OF CHLORIDE IONS ON THE DISSOLUTION BEHAVIOR OF Fe-Ni ALLOYS
Dale O. Condit Oct. 1972 22 p refs Presented at Intern. Congr. on Metallic Corrosion (5th), Tokyo, 21-27 May 1972
(AF Proj. 7021)
(AD-751258; ARL-72-0124) Avail: NTIS CSCL 11/6

The potentiostatic dissolution behavior of Fe-25Ni was studied to determine the effect of (Cl(-)) ion additions in IN H2SO4 at 25C. Specimens were dissolved at four potentials in the active and passive ranges and at three (Cl(-)) concentrations where large changes in dissolution behavior were expected. Current-time behavior, specimen weight change, and solution analysis for Fe and Ni were determined to characterize the dissolution behavior of the alloy. Current-time behavior and post-test surface characterization indicated that pitting occurred at all potentials and (Cl(-)) concentrations. Atomic absorption analysis for Fe and Ni in the solutions indicated that (Cl(-)) has no effect in the active dissolution of either component, increases in (Cl(-)) increase the dissolution of each in the passive range, and no enrichment or preferential dissolution of either component occurred under any exposure condition. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-16575*# Boeing Co., Seattle, Wash. Aerospace Group.
DEVELOPMENT OF SPACE STABLE SEMITRANSPARENT POLYQUINOXALINE FILMS Final Report, 10 Dec. 1971 - 24 Nov. 1972
P. M. Hergenrother 24 Nov. 1972 28 p refs
(Contract NAS1-11255)
(NASA-CR-112213) Avail: NTIS HC $3.50 CSCL 11G

Three polyphenylquinoxalines underwent preliminary study for potential use as coatings on aircraft and spacecraft. These polymers were prepared from the reaction of 3,3 prime, 4,4 prime-tetraaminodiphenyl ether with p,p prime-oxydibenzil and with m -bis (phenylglyoxalyl) benzene and from the reaction of 3,3 prime, 4,4 prime-tetraaminodiphenylsulfone with p,p prime-oxydibenzil. High purity reactants and solvents were used in polymer preparation to minimize color in the polymer films. High molecular weight polymers were prepared at ambient temperature at 12 to 15 percent concentration by upsetting the stoichiometry by 0.5 to 1.0 percent in favor of the bis (1,2-dicarbonyl) reactant. A portion of each polymer was endcapped with benzil and with o-phenylenediamine. Certain properties of the endcapped and unendcapped versions of each polymer are compared. Uniform films of 2.0 and 0.1 mil thickness were cast from solutions of the unendcapped and endcapped versions of each of the three polymers. Author

N73-16576*# Scientific Translation Service, Santa Barbara, Calif.
USE OF COMPOSITE MATERIALS IN AIRCRAFT STRUCTURES
A. S. Volmir, V. F. Pavlenko, and A. T. Ponomarev Washington NASA Jan. 1973 17 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), Jan. - Feb. 1972 p 105-112
(Contract NASw-2483)
(NASA-TT-F-14648) Avail: NTIS HC $3.00 CSCL 11D

The applicability of a group of composite boron and carbon plastic fiber materials in aircraft structural component and engine designs is evaluated as an approach to the damping of aircraft reactions to dynamic and impact forces. The properties of some well-developed composites are compared with those of conventional materials. Examples are given for some aircraft applications of composites. Author

N73-16577*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RECONSTITUTED ASBESTOS MATRIX Patent Application
Hoyt McBryar, inventor (to NASA) Filed 22 Jan. 1973 18 p
(NASA-Case-MSC-12568-1; US-Patent-Appl-SN-325784) Avail: NTIS HC $3.00 CSCL 11D

The production of an asbestos matrix is described suitable for use in a fuel cell or electrolysis cell. It has a greater porosity and bubble pressure for a given thickness, improved homogeneity, and more uniform thickness than heretofore known. The matrix is produced by first shredding the asbestos; forming a slurry of the asbestos with water or a low boiling hydrocarbon, preferably an alcohol such as methanol; forming a mat by

passing the slurry through a properly sized porous plaque; drying the mat so produced; and rolling the mat to yield the desired thickness and surface finish. NASA

N73-16578*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF OXYGEN CONCENTRATION ON THE BOUNDARY LUBRICATING CHARACTERISTICS OF AN UNFORMULATED C-ETHER TO 300 C
William R. Jones, Jr. Washington Feb. 1973 17 p refs
(NASA-TN-D-7155; E-6987) Avail: NTIS HC $3.00 CSCL 11H

The effect of oxygen concentration on the boundary lubricating characteristics of an unformulated C-ether was studied with the use of a ball-on-disk sliding-friction apparatus. Results were compared with those obtained with a polyphenyl ether. Experimental conditions included oxygen concentrations ranging from 20 percent (air) to 0.001 percent (nitrogen), a load of 1 kilogram, a sliding speed of 17 meters per minute, and disk temperatures ranging from 20 to 300 C (77 to 572 F). The C-ether yielded better boundary lubricating characteristics than did the polyphenyl ether in air and nitrogen over most of the temperature range. The C-ether exhibited lower wear at high oxygen levels (10 to 20 percent O2) from 25 to 200 C (77 to 392 F) and at low oxygen levels (0.001 to 1.0 percent O2) from 200 to 300 C (392 to 572 F). Friction polymer was observed around the wear scars of most test specimens. Friction polymer generation and its effect on wear are discussed in light of current theories. Author

N73-16579*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREPARATION AND PROPERTIES OF POLYTETRAFLUOROETHYLENE IMPREGNATED WITH RHENIUM OXIDES
Harold F. Leibecki and Robert W. Easter Washington Feb. 1973 20 p refs
(NASA-TN-D-7166; E-7026) Avail: NTIS HC $3.00 CSCL 11D

The results of tests carried out to determine the properties of polytetrafluorethylene (PTFE) impregnated with rhenium oxides are presented. The tests included measurement of physical properties of the impregnated material and investigation of the effects of preparation process variables. Based on the latter tests a mechanism to describe the permeation process is postulated which identifies the rate controlling step to be diffusion of ReF6 molecules into the solid during the initial ReF6 soak. Physical property tests indicated that the electronic conductance is increased by many orders of magnitude while the desirable properties of the PTFE remain virtually unchanged. Author

N73-16580*# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
EFFECTS OF ADDITIVES ON VOLUME CHANGE ON MELTING, SURFACE TENSION, AND VISCOSITY OF LIQUID ALUMINUM OXIDE
J. Lambert Bates and J. J. Rasmussen 1 Jun. 1972 40 p refs
(Contract NAS3-14308)
(NASA-CR-120910) Avail: NTIS HC $4.00 CSCL 11E

The effects of various oxide additives on the volume change on melting, the surface tension, and the viscosity of liquid Al2O3 were studied. Additives of Sm2O3, MgO, and Y2O3 which form solid solutions, compounds, and multiphase solids with Al2O3 were studied. A review of the property data for Al2O3 and Al2O3 containing oxide additives is presented. Oxide additives to Al2O3 reduce the volume change on melting and with the exception of SiO2 lower the viscosity; surface tensions change with oxide additives, but changes vary with different container material. Viscosity and volume change on melting appeared to be significantly more important for studying the properties of liquid oxides than surface tension. Supercooling of 270 K of yttrium aluminum garnet was observed. Author

N73-16581# Sandia Labs., Albuquerque, N.Mex.
ROOM TEMPERATURE ELECTRICAL PROPERTIES AND DOPANT PRECIPITATION FOR SiGe THERMOELECTRIC ALLOYS
R. D. Nasby and E. L. Burgess 1972 23 p refs Presented at 7th Intersoc. Energy Conversion Eng. Conf., San Diego, Calif., 25 Sep. 1972 Sponsored by AEC
(SC-DC-721020; Conf-720925-5) Avail: NTIS

The results from a study on properties of SiGe alloys for use as thermoelectric materials are reported. This study concentrates on 80 a/o Si alloys, as this composition appears best for long-life designs with respect to minimum performance degradation. Room temperature electrical resistivity and Seeback coefficients are reported for 80 a/o Si, hot pressed alloys as a function of carrier concentration. For p-type alloys, Hall mobilities are presented and Hall coefficient data are compared with chemical determination of the boron dopant content to obtain the Hall factor. Precipitation of the phosphorus and boron dopants which lead to performance degradation are discussed. Results of applying the model of Lifshitz and Slyozov to phosphorus precipitation for prediction of resistivity data obtained from a long term anneal are given. Author

N73-16582# California Univ., Livermore. Lawrence Livermore Lab.
FIBER STRENGTH OF S-GLASS/EPOXY COMPOSITES UNDER BIAXIAL LOADING
T. T. Chiao and A. D. Commins 4 May 1972 10 p refs Presented at 4th SAMPE Natl. Tech. Conf., Palo Alto, Calif., 17-19 Oct. 1972 Submitted for publication Sponsored by AEC
(UCRL-73772; Conf-721009-1) Avail: NTIS

The fiber properties of simple and complex S-glass/epoxy composites in the absence of processing effect were correlated. Only one package of fiber from each form of S-glass was used. With the same matrix, one operator made all the strand and vessel specimens on the same filament winding machine. The vessel designs were varied to get either hoop or axial fiber failures at burst. Under biaxial loading, the average ultimate strength of the S-glass fiber varied from a minimum of 323 ksi to a maximum of 436 ksi, depending on the degree of fiber crossover of the test. Going from strand to vessel can be attributed neither to processing nor to biaxial loading. Author

N73-16583# Sandia Labs., Albuquerque, N.Mex.
AROMATIC POLYIMIDE SYNTACTIC FOAM
Peter B. Rand Jun. 1972 17 p refs Presented at 3d Intern. Cellular Plastics Conf., Montreal, 27-29 Sep. 1972 Sponsored by AEC
(SC-DC-722297; Conf-720915-2) Avail: NTIS

A polyimide syntactic foam has been developed. This system, designated HTF-60, has good mechanical properties and excellent retention of these properties up to 700 F. The chemistry, processing and physical properties of this system are presented. The foam has a nominal density of 23.0 pounds per cubic foot. Author

N73-16584# Sandia Labs., Albuquerque, N.Mex.
MECHANICAL AND THERMAL EXPANSION PROPERTIES OF A PARTICULATE FILLED POLYMER
Gilbert W. Brassell and Kenneth B. Wischmann Nov. 1971 28 p refs Sponsored by AEC
(SC-DR-70-617) Avail: NTIS

The use of particulate filled polymer formulations over wide temperature ranges has resulted in a need to better understand their mechanical behavior. In this investigation, a crosslinked epoxy-urethane polymer filled with Al2O3 particles was studied. Mechanical and thermal expansion properties were determined at ambient and liquid nitrogen temperatures and compared to theoretical predictions. Other parameters under consideration were volume fraction and adhesion between filler and matrix. The theoretical equations employed for predicting mechanical properties appear fairly reliable at ambient temperature and unreliable at liquid nitrogen temperatures. The degree of bonding between filler and matrix influences mechanical properties at ambient temperature but at liquid nitrogen temperature no difference in properties due to matrix filler bonding was evident. This result is attributed to compressive stresses on the filler particles resulting from the lower thermal expansion of the filler. Author (NSA)

N73-16585# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer

Aerobiologie.

AERODYNAMIC DIAMETER OF LATEX AGGREGATES AND ASBESTOS FIBERS [DER AERODYNAMISCHE DURCHMESSER VON LATEXAGGREGATEN UND ASBESTFASERN]

Werner Stoeber and Dieter Hochrainer Bonn Bundeswehramt 1972 47 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-72-10) Avail: NTIS HC $4.50; Bundeswehramt 25 DM

The aerodynamic diameter of clusters and chain aggregates of monodispersive latex spheres of submicron size and of asbestos fibers was determined with an aerosol spiral centrifuge. The results for cluster aggregates can easily be interpreted theoretically. The aerodynamic diameter of chain aggregates can be represented by an analytical expression involving the sphericity of the particles. It is concluded that the aerodynamic diameter is only slightly influenced by the chain length but predominantly proportional to the diameter of the primary spheres. Similar results were obtained from experiments with asbestos fibers. The findings are discussed with regard to deposition properties in the size range of submicron aerodynamic diameters.

Author (ESRO)

N73-16586# California Univ., Livermore. Lawrence Livermore Lab.

CHARACTERIZATION OF AN EPOXY SYSTEM FOR FILAMENT WINDING

T. T. Chiao and L. P. Althouse 4 May 1972 8 p ref Presented at 4th Natl. SAMPE Tech. Conf., Palo Alto, Calif., 17-19 Oct. 1972 Submitted for publication Sponsored by AEC

(UCRL-73773; Conf-721009-2) Avail: NTIS

An epoxy system for filament winding has been characterized: the system is a blend of the diglycidyl ether of bisphenol-A and bis(epoxycyclopentyl) ether resin cured with mixed aromatic amines. Cast tensile specimens show a strength of 16.5 ksi, a modulus of 536 ksi, and 6.2% rupture elongation. The recommended cure cycle is 4 hr at 90 C, a 1-hr ramp from 90 deg to 160 C, 1 hr at 160 C, and a 2-hr cooling from 160 C to room temperature. It has been found that a dielectrometer is useful for studying the cure of epoxies; however, its potential has not been fully explored. To reduce the data scatter of the brittle epoxy systems the previously published procedure for the fabrication and testing of epoxy tensile specimens has been refined.

Author

N73-16587# Army Foreign Science and Technology Center, Charlottesville, Va.

SELECTIVITY OF EFFECTS OF STRENGTH REDUCTION IN POLYMER MATERIALS UNDER THE ACTION OF SURFACE-ACTIVE MEDIA

E. D. Shchukin, A. I. Soshko, O. A. Mikityuk, and A. N. Tynnyi 28 Jul. 1972 12 p refs Transl. into ENGLISH from Fiz.-Khim. Mekh. Mat. (USSR), no. 2, 1971 p 33-39

(AD-751615; FSTC-HC-23-114-72) Avail: NTIS CSCL 11/9

Research comparing Rebinder's Effect on two different polymer materials, polyethylene and PMMA, is discussed.

Author (GRA)

N73-16588# ARO, Inc., Arnold Air Force Station, Tenn.

RESEARCH AND DEVELOPMENT TESTING OF YTTRIA/RARE EARTH STABILIZED ZIRCONIA MATRIX BRICKS IN THE PILOT TEST UNIT (PTU) AT AEDC Final Report, Feb. 1969 - Apr. 1971

C. R. Tinsley AEDC Nov. 1972 134 p refs

(Contract F40600-73-C-0004; ARO Proj. PL3922; ARO Proj. RR5202)

(AD-751298; ARO-ETF-TR-72-80; AEDC-TR-72-161) Avail: NTIS CSCL 11/2

Presented are the comprehensive results of research testing accomplished with the Pilot Test Unit (PTU) at AEDC since February 1969. The major objective of this continuing test program is to develop operational techniques and suitable ceramic materials in direct support of a full-scale, intermittent airflow, high enthalpy, high pressure test facility capable of testing aircraft and missile models, components, and engines in the Mach 2 to 8 flight regime. Eighty-four blowdown runs accomplished in the PTU are reported herein. Heater maximum operating conditions of 1850 psi and 4450F were accomplished during testing.

Author (GRA)

N73-16589# ILC, Inc., Sunnyvale, Calif.

TRANSLUCENT BERYLLIUM OXIDE AS ENVELOPE MATERIAL FOR HIGH INTENSITY ARC LAMPS Interim Report

John Richter Aug. 1972 52 p

(Contract N00014-71-C-0384)

(AD-751661; R-ILC-72-27) Avail: NTIS CSCL 13/1

The report describes work performed to evaluate translucent beryllium oxide as an envelope material for flash and CW lamps of high intensity.

Author (GRA)

N73-16590# Goodyear Aerospace Corp., Litchfield Park, Ariz.

DESIGN CRITERIA: TRANSPARENT POLYCARBONATE PLASTIC SHEET Final Technical Report, 19 Apr. 1971 - 1 May 1972

Richard S. Hassard Aug. 1972 189 p refs

(Contract F33615-71-C-1465; AF Proj. 7381)

(AD-751551; GERA-1815; AFML-TR-72-117) Avail: NTIS CSCL 11/9

An accurate method is proposed for the determination of lithium stearate in sebacate-base semi-fluid lubricants. The sample is treated with dilute hydrochloric acid and an extraction is performed with ethyl ether to remove diisopropyl phosphite which would otherwise interfere by causing the subsequent precipitation of lithium phosphate or lithium metaphosphate. The aqueous extract is then evaporated to fumes of perchloric acid and the lithium is determined by atomic absorption. Results are given for lithium stearate in ten samples of lubricant. The quality assurance requirements of lithium stearate used in sebacate-base semi-fluid lubricants were investigated. The following characteristics of lithium stearate were studied: moisture, melting point, lithium content, stearate content, melting point of fatty acid, iodine number of fatty acid, free acid, free alkali, pH, water-soluble matter, chloride, and granulation.

Author (GRA)

N73-16591# Ministry of Defence, London (England).

THE YIELD BEHAVIOR OF RIGID POLYMERS Report for Oct. 1966 - Oct. 1969

J. A. Jukes (Trinity Coll., Cambridge) Jun. 1972 125 p refs

(AD-751055; D-MAT-185; BR-28277) Avail: NTIS CSCL 11/9

The yield behaviour of solid polymers has been examined, with special reference to that of the glassy amorphous polymers. Considering polymethyl methacrylate to be a typical glassy amorphous polymer, the effects of strain rate and temperature on the yield stress have been determined by taking stress-strain curves in simple plane strain compression. The variation of the plane strain compressive yield stress with applied tension and compression has also been determined for polymethyl methacrylate and several other polymers. It was shown that the hydrostatic component of stress had a significant effect on the yield behaviour of the polymers studied. This has been considered in terms of the Tresca and von Mises yield criteria modified for pressure dependence.

Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-16592*# Brown Univ., Providence, R.I. Center for Dynamical Systems.

PERTURBED NONLINEAR DIFFERENTIAL EQUATIONS

T. G. Proctor [1972] 26 p refs

(Grant NGL-40-002-015)

(NASA-CR-130277) Avail: NTIS HC $3.50 CSCL 12A

The existence of a solution defined for all t and possessing a type of boundedness property is established for the perturbed nonlinear system $y = f(t,y) + F(t,y)$. The unperturbed system $x = f(t,x)$ has a dichotomy in which some solutions exist and are well behaved as t increases to infinity, and some solutions exist

and are well behaved as t decreases to minus infinity. A similar study is made for a perturbed nonlinear differential equation defined on a half line, R+, and the existence of a family of solutions with special boundedness properties is established. The ideas are applied to integral manifolds. Author

N73-16593*# Bell Aerospace Co., Buffalo, N.Y.
FINITE ELEMENT SOLUTION FOR ENERGY CONSERVATION USING A HIGHLY STABLE EXPLICIT INTEGRATION ALGORITHM Final Technical Report, Jun. - Oct. 1972
A. J. Baker and Paul D. Manhardt Oct. 1972 56 p refs
(NAS5-11935)
(NASA-CR-130149; Rept-9500-920257) Avail: NTIS HC $5.00 CSCL 12A

Theoretical derivation of a finite element solution algorithm for the transient energy conservation equation in multidimensional, stationary multi-media continua with irregular solution domain closure is considered. The complete finite element matrix forms for arbitrarily irregular discretizations are established, using natural coordinate function representations. The algorithm is embodied into a user-oriented computer program (COMOC) which obtains transient temperature distributions at the node points of the finite element discretization using a highly stable explicit integration procedure with automatic error control features. The finite element algorithm is shown to possess convergence with discretization for a transient sample problem. The condensed form for the specific heat element matrix is shown to be preferable to the consistent form. Computed results for diverse problems illustrate the versatility of COMOC, and easily prepared output subroutines are shown to allow quick engineering assessment of solution behavior. Author

N73-16594# Northeastern Univ., Boston, Mass. Dept. of Physics.
STATISTICS OF PARALLEL DIMERS ON AN mxn LATTICE
F. Y. Wu Dec. 1972 3 p refs
(Grant NSF GH-35822)
(NUB-2166) Avail: NTIS HC $3.00

The problem of occupation statistics of parallel dimers (dumbbells) on an mxn lattice is solved using the method of transfer matrix. Author

N73-16595# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
VARIABLE ORDER FILTERS
Marvin Blum Dec. 1971 40 p refs
(AD-751124; P-835; IDA/HQ-71-13827) Avail: NTIS CSCL 12/1

The theory of variable order filters was derived from the author's previous studies on the application of polynomial splines and generalized splines to statistical filter theory. The current algorithms for the variable order filters are applications of and extensions of the spline function concepts. This class of filters has application to smoothing and prediction of sampled data systems for the following classes of state estimation problems: Estimation of the state vector of a linear dynamic system with rapidly changing trajectories as, for example, a maneuvering vehicle; High precision estimation of the state vector based on long observational intervals where the estimation accuracy may be limited by modelling errors; and, Estimation of the state vector when certain components of the state vector are subject to intermittent discontinuous changes as, for example, staging rockets. GRA

N73-16596# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
OPTIMAL LINEAR INDEXES FOR SOME SELECTION PROBLEMS Final Report
Thomas E. Reeves Oct. 1972 96 p refs
(AF Proj. 7071)
(AD-751257; ARL-72-0123) Avail: NTIS CSCL 12/1

The problem considered is that of constructing a linear index or linear combination of observable variates so as to maximize the correlation between the index and an unobservable criterion variate, subject to constraints that the correlations between the index and certain other criterion variates be equal to, greater than or equal to, or proportional to specified constants. Under certain circumstances, this problem is mathematically equivalent to that of deriving a selection procedure having a given intensity for choosing individuals or items from a population so as to maximize the post-selection mean of the primary criterion variate subject to restrictions on the post-selection means of the other criterion variates. A problem of this type occurs in selecting cadets for the Air Force Academy, where a battery of tests is administered to each candidate and the results are used in making the selections. Here, the success of a selection procedure is determined by the actual performance of the selected cadets at the Academy, as measured by criterion variates like academic score and military rating. Similar selection problems are commonplace in genetic settings. Author (GRA)

N73-16181 Illinois Univ., Urbana.
ON SOME APPLICATIONS OF SINGULAR PERTURBATIONS OF ORDINARY DIFFERENTIAL EQUATIONS
Petar V. Kokotovic *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 119-128 refs (For availability see N73-16169 07-09)
Copyright.

N73-16182 Louvain Univ. (Belgium). Inst. de Mathematique Pure et Appliquee.
THE CONSISTENCY OF SINGULAR PERTURBATIONS IN SYSTEMS WITH PARASITIC ELEMENTS
P. Habets *In* Liege Univ. Seminar on Stability of Large-Scale Power Systems Jun. 1972 p 129-134 refs Sponsored in part by CNR (For availability see N73-16169 07-09)
Copyright.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-16597 National Lending Library for Science and Technology, Boston Spa (England).
[VISIBILITY MEASUREMENTS FROM THE GROUND AND AN AERODROME]
[1972] 64 p refs Transl. into ENGLISH from Met. Nat. (Paris), no. 76
(NLL-M-20785-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 6 NLL photocopy coupons

Articles on the observation, measurement, and the automatic calculation of runway visibility are presented. For individual titles, see N73-16598 through N73-16599.

N73-16598 National Lending Library for Science and Technology, Boston Spa (England).
OBSERVATION AND MEASUREMENT OF VISIBILITY AT THE GROUND
C. PerrinDeBrichambaut *In its* Visibility Measurements from the Ground and an Aerodrome [1972] p 2-38 (For availability see N73-16597 07-20)

The determination of visibility on an airport is discussed. Definitions of daylight and night visibilities, meteorological optical range, runway visual range, quantities and fundamental units are presented. Visibility measuring instruments which depend on measuring the opacity of the atmosphere, or the mean coefficient of extinction discussed include telephotometric instruments, extinction instruments, and photoelectric transmission instruments. The orientation and calibration of equipment is discussed along with the standardization of measuring procedures. F.O.S.

N73-16599 National Lending Library for Science and Technology, Boston Spa (England).
AUTOMATIC CALCULATION OF RUNWAY VISUAL RANGE ON AN AERODROME
A. Bettan *In its* Visibility Measurements from the Ground and an Aerodrome [1972] p 39-61 (For availability see N73-16597 07-20)

The use of a LYNX controlled transmissometer is discussed for rapid measurement and continuous dissemination of visibility to aircraft on final approach, or takeoff. The general principles used to calculate horizontal visibilities are reviewed, and the collection and dissemination of visibilities by the transmissometer

are described along with the LYNX computer programming.
F.O.S.

N73-16600 National Lending Library for Science and Technology, Boston Spa (England).
CATALOGUE OF EUROPEAN LARGE SCALE WEATHER PATTERNS
P. Hess and H. Brezowsky [1972] 35 p refs Transl. into ENGLISH from Ber. Deut. Wetterdienst (West Germany), v. 15, no. 113 p 2-14 and A1 No diagrams, etc.; to be used in conjunction with original paper
(NLL-M-9145-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The classification, description, and statistical treatment of large-scale weather patterns are discussed. The circulation patterns are determined by the position of the steering centers and by the extent of the frontal zone. The types of circulation and large-scale weather patterns are described, and details are given on individual directional patterns and on high and low pressure patterns over Central Europe. Relative frequencies and singularities in the large-scale weather patterns are also considered. N.E.N.

N73-16601 Engineering Sciences Data Unit, London (England).
CHARACTERISTICS OF WIND SPEED IN THE LOWER LAYERS OF THE ATMOSPHERE NEAR THE GROUND: STRONG WINDS (NEUTRAL ATMOSPHERE)
Nov. 1972 40 p refs Sponsored by Roy. Aeron. Soc., Inst. of Chem. Engr., Inst. of Mech. Engr., Inst. of Structural Engr.
(ESDU-72026) Copyright. Avail: Issuing Activity

The behavior and characteristics of atmospheric wind in the lower layers of the atmosphere are discussed. A method for determining a reliable value of wind speed based on geographical location and various correction factors to account for local conditions and averaging time which are different from the reference conditions is analyzed. The effects of various parameters on wind conditions are described. Values of the surface roughness parameter and data for particular terrain classifications are tabulated. Author

N73-16602 Wisconsin Univ., Madison.
PROPERTIES OF TROPICAL CLOUD CLUSTERS DETERMINED FROM GEOSTATIONARY SATELLITE PICTURES Ph.D. Thesis
Arthur Frederick Hasler 1972 331 p
Avail: Univ. Microfilms Order No. 72-13974

The use of geostationary satellite pictures for observations concerning tropical convective ensembles or cloud clusters is treated. The synoptic-scale wind, divergence and vorticity fields in the vicinity of cloud clusters was observed. A close-up time-lapse movie technique was developed by which cloud trajectories were measured from a geostationary satellite with 1.5 meters/second (m/s) accuracy at better than synoptic-scale resolution for low clouds over tropical oceans. For 120 low cloud trajectories 68% of the speeds were within 2.5 m/s of the 950 mb rawinsonde winds. High clouds were not abundant enough to provide synoptic-scale resolution everywhere. An objective polygon technique was developed to measure the divergence and vorticity of the synoptic-scale cloud trajectory field. Dissert. Abstr.

N73-16603# Finnish Meteorological Inst., Helsinki.
THE RELATIONSHIP BETWEEN VERTICAL VELOCITY IN A BAROCLINIC MODEL AND THE OCCURRENCE OF RAIN AND CLOUDS IN FINLAND
Hannu Savijaervi Jul. 1972 19 p refs
(TR-4) Avail: NTIS HC $3.00

In the filtered quasi-geostrophic model used by the Finnish Meteorological Institute, the mean large-scale vertical component of the wind for the layer between 1000 and 500 mb is computed. The relationship between this quantity and the occurrence of rain and clouds is statistically investigated by classifying forecasts of the vertical velocity at six hour intervals with corresponding weather observations at 41 stations in Finland during a one year period. Thus a two-dimensional frequency distribution can be established. The results are presented in consideration of different weather parameters, time periods and area groups.
Author

N73-16604# Finnish Meteorological Inst., Helsinki.
OBSERVATIONS OF RADIOACTIVITY 1971
1972 69 p
(Rept-11) Avail: NTIS HC $5.50

The measurement of radioisotopes in the air and rain water is discussed. The subjects presented are: (1) the fraction of aerosol beta activity that decays within 4 hours, and (2) the fraction of aerosol beta activity that remains four days after the end of the sampling period. Radioactivity measurements are limited to Helsinki and Ivalo, Finland. Author

N73-16605*# Texas A&M Univ., College Station.
AN INVESTIGATION OF THE SUTCLIFFE DEVELOPMENT THEORY
Joseph Daniel Dushan Washington Jan. 1973 76 p refs
(Contract NAS8-26751)
(NASA-CR-2192; M107) Avail: NTIS HC $3.00 CSCL 04B

Two case studies were used to test the Sutcliffe-Peterssen development theory for both cyclonic and anticyclonic development over the eastern United States. Each term was examined to determine when and where it made a significant contribution to the development process. Results indicate the advection of vorticity at the level of non-divergence exerts the dominant influence for initial cyclone development, and that the thermal terms (advection of thickness, stability, and diabatic influence) become important after development has begun. Anticyclonic development, however, depends primarily on the stability term throughout the life cycle of the anticyclone. Simple procedures for forecasting the development and movement of cyclones and anticyclones are listed. These rules indicate that routine National Meteorological Center analyses may be used to locate areas where the positive advection of 500-mb vorticity, indicative of cyclonic development, coincides with regions of severe weather activity. The development of anticyclones also is predicted easily. Regions of increasing stability, indicating anticyclonic development, may be located by use of National Meteorological Center radar summaries and analyses for 1000-500-mb thickness. A test of these techniques found them to be satisfactory for the case examined. Author

N73-16606# Chicago Univ., Ill. Cloud Physics Lab.
INADVERTENT WEATHER MODIFICATION IN THE ST. LOUIS AREA Final Technical Report, 1 May 1971 - 31 Dec. 1972
Roscoe R. Braham, Jr. 15 Dec. 1972 105 p refs
(Grant NSF GA-28190X1; Proj. Metromex)
(TN-45) Avail: NTIS HC $7.25

During the winter and summer 1972, the Lockheed Lodestar cloud physics airplane was operated for a total of 58 scientific flights. The TPS-10, RHI radar was operated during the summer period taking data on 39 precipitation days. Special features of the summer operations were attempts to detect a weekend effect in CCN spectra and a series of flights every three hours (divided into two separate days because of crew limitations) in which to learn more about the diurnal character of the urban heat island.
Author

N73-16607*# Texas A&M Univ., College Station. Dept. of Meteorology.
ATMOSPHERIC ENERGETICS AS RELATED TO CYCLOGENESIS OVER THE EASTERN UNITED STATES Ph.D. Thesis
Philip Walter West Washington NASA Jan. 1973 126 p refs
(Contract NAS8-26751)
(NASA-CR-2189; M-108) Avail: NTIS HC $3.00 CSCL 04B

A method is presented to investigate the atmospheric energy budget as related to cyclogenesis. Energy budget equations are developed that are shown to be advantageous because the individual terms represent basic physical processes which produce changes in atmospheric energy, and the equations provide a means to study the interaction of the cyclone with the larger scales of motion. The work presented represents an extension of previous studies because all of the terms of the energy budget equations were evaluated throughout the development period of the cyclone. Computations are carried out over a limited atmospheric volume which encompasses the cyclone, and boundary fluxes of energy that were ignored in most previous studies are evaluated. Two examples of cyclogenesis over the eastern United States were chosen for study. One of the cases

(1-4 November 1966) represented an example of vigorous development, while the development in the other case (5-8 December 1969) was more modest. Objectively analyzed data were used in the evaluation of the energy budget terms in order to minimize computational errors, and an objective analysis scheme is described that insures that all of the resolution contained in the rawinsonde observations is incorporated in the analyses. Author

N73-16608# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
THE DFVLR LIDAR SYSTEM-3 [DAS DFVLR-LIDAR-SYSTEM 3]
Hartmut Herrmann and Christian Werner Jun. 1972 39 p refs In GERMAN; ENGLISH summary
(DLR-MITT-72-26) Avail: NTIS HC $4.00; DFVLR Porz-Wahn: 11,60 DM

The DFVLR LIDAR System 3 for determination of water vapor concentration in the troposphere is described, and an example of its application is given. The measurement is based on the shift of the emitted laser line by temperature variation of the ruby over the range of a water vapor absorption line, and employs two ruby laser transmitters. The receiver is a Newtonian telescope with a mirror diameter of 24.8 cm. The signal processing facility is also described. Author (ESRO)

N73-16609# Institut Royal Meteorologique de Belgique, Brussels.
AEROLOGICAL CLIMATOLOGY: UCCLE STATION (06447) [CLIMATOLOGIE AEROLOGIQUE: STATION D'UCCLE (06447)]
P. Defrise, R. Sneyers, W. Struylaert, and J. Vanlsacker 1972 45 p refs In FRENCH; ENGLISH summary
(Publ-Ser-A-77) Avail: NTIS HC $4.25

Climatology of the free atmosphere was studied, based on the soundings for the period 1951-1965, for each variable (geopotential; temperature, mixing-ratio). The distribution of daily values, monthly mean and extremes were determined by estimation of appropriate parameters. A better estimation of these parameters was obtained through the seasonal variation study with a selective harmonic analysis. The persistence of the daily values was also investigated. Author (ESRO)

N73-16610# France. Direction de la Meteorologie Nationale, Paris.
THE CLIMATE OF MARTINIQUE [LE CLIMAT DE MARTINIQUE]
M. Perrusset and S. Selbonne Oct. 1972 68 p refs In FRENCH
(Mono-86) Avail: NTIS HC $5.50

The periodic variations of the Martinique climate are reported, including atmospheric circulation, tropical storms, and cyclones. An analysis of the tropical storm Dorothy is given. A statistical analysis of data recorded at different weather stations on rainfall, temperature, evaporation, humidity, ground wind, etc. is also given. ESRO

N73-16611# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
CLOUD TEMPERATURE AND HEIGHT MEASUREMENTS USING RADIOSONDE AND LIDAR [WOLKENTEMPERATUR UND WOLKENHOEHENMESSUNG MIT RADIOMETER UND LIDAR]
C. Werner Bonn Bundeswehramt 1972 111 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-72-17) Avail: NTIS HC $7.75; Bundeswehramt 25 DM

The measurement of cloud base temperatures by means of a radiometer is described and results are compared with lidar and radiosonde measurements. Differences of up to -40 deg C were determined. The method described is based on estimates of the half value thickness of the cloud profiles measured by lidar. The real emissivity can be calculated from existing data on the emissivity of clouds of different thickness. Comparison of calculated and measured radiation temperatures shows that this method can be useful. The influence of tri-atomic gases (water vapor, carbon dioxide and ozone) between cloud and radiometer is evaluated. A conception for an automatic cloud cover indicator system is proposed. ESRO

N73-16612# Transportation Systems Center, Cambridge, Mass.
CLIMATIC IMPACT ASSESSMENT PROGRAM. PROCEEDINGS OF THE SURVEY CONFERENCE
A. E. Barrington Sep. 1972 289 p refs Conf. held at Cambridge, Mass., 15-16 Feb. 1972
(Contract DOT-OS-320)
(PB-212427; DOT-TSC-OST-72-13) Avail: NTIS HC $3.00 CSCL 04A

The report contains the proceedings of a survey conference, concerning the impact of climatic changes which might result from perturbation of the upper atmosphere by the exhaust effluent of a world high altitude aircraft fleet, as projected to 1990. The reports deal with the general categories of engine emissions, the natural stratospheric perturbations, and risk/benefit analysis. All but one of the talks are included in the volume, each followed by an abbreviated version of the ensuing open discussion. GRA

N73-16613# Battelle Columbus Labs., Ohio.
HAZE FORMATION: ITS NATURE AND ORIGIN
William E. Wilson, Jr., Warren E. Schwartz, and G. W. Kinzer 28 Jan. 1972 77 p refs
(Grant AP-00828)
(PB-212609; CRC-APRAC-CAPA-6-68-3) Avail: NTIS HC $3.00 CSCL 13B

Aerosols were analyzed which were obtained in New York City, Great Smoky Mountains, in laboratory smog chamber facilities, and from primary automobile exhaust. The results indicated that certain organic chemicals were present in aerosols associated with auto exhaust which were not present in aerosols from rural atmospheres. On the other hand, at least one organic compound was present in aerosols from rural atmospheres which was not present in urban air aerosol samples. These results indicate that the presence of certain organic compounds in aerosol samples may indicate the origin of haze. GRA

N73-16614# Texas A&M Research Foundation, College Station.
PREDICTION OF ENVIRONMENTAL PARAMETERS Annual Report, 20 Oct. 1970 - 20 Oct. 1971
R. A. Clark, W. H. Clayton, F. S. Darby, P. Das, and K. D. Gilbert Nov. 1971 243 p
(Contract DAAB07-68-C-0073; DA Proj. 1T0-14501-B-81-A)
(AD-751744; A/M-Ref-71-29-A; ECOM-0073-5; AR-4) Avail: NTIS CSCL 04/2

The basic goal of the program is the development of mathematical-meteorological models which will permit improved objective forecasting in all scales. The topics discussed include the following: Turbulent flow definition through Reynolds stress measurements; Change of intensity in cloud systems associated with easterly perturbations as they move over areas of differing water temperature; Mesoscale analyses using radar and micro-meteorological measurements; Studies of mesoscale air-sea interaction; Tropical rainfall patterns; and Numerical modeling of the microdynamics of warm cumulus. GRA

N73-16615# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICS OF CLOUDS, PRECIPITATION AND ARTIFICIAL MODIFICATION. TRANSACTIONS
23 Jun. 1972 260 p refs Transl. into ENGLISH from Tr. Ukr. Nauch.-Issled. Gidrometeorol. Inst. (USSR), no. 77, 1969 p 1-160
(AD-751501; FTD-MT-24-1888-71) Avail: NTIS CSCL 04/2

The report is a collection of selected articles dealing with investigations into the elementary processes of precipitation particle formation (electrostatic charging of droplets, crystal generation, etc.). Methodological problems relating to radar and aircraft precipitation measurements are discussed. Results are cited of tests involving the manipulation of supercooled clouds and fogs, along with the findings of cloud characteristic studies in the case of active influences of these formations. Author (GRA)

N73-16616# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

A GENERAL-PURPOSE METEOROLOGICAL ROCKET DATA REDUCTION PROGRAM
Mary Ann B. Seagraves Aug. 1972 116 p refs
(DA Proj. 1T6-65702-D-12707)
(AD-751780; ECOM-5462) Avail: NTIS CSCL 04/2

METROC is a general-purpose meteorological rocket data reduction program designed to be run on the Univac 1108 computer system at White Sands Missile Range, New Mexico (WSMR). Wind data may be input on cards or may be computed from radar data input on digital tape. Temperature data may be input on data cards. Layer winds are computed for selected altitudes, as are corrected temperatures. Pressure and densities are derived by using the hydrostatic equations and an initial data point from a conjunctive rawinsonde measurement. Some specially formatted data may be output to meet project requirements at WSMR. Author (GRA)

N73-16617# Naval Intelligence Support Center, Washington, D.C. Translation Services Div.
SHIPBOARD METEOROLOGICAL SYSTEMS
V. V. Kuman 26 Oct. 1972 12 p refs Transl. into ENGLISH from Sudostroenie (USSR), no. 12, 1970 p 41-45
(AD-751691; NISC-Trans-3359) Avail: NTIS CSCL 04/2

Complex automation of navigational processes is one of the basic trends in technological progress in the merchant fleet. A necessary condition for achievement of such automation is the availability of precise and objective information on the surrounding situation, including the meteorological environment. More and more meteorological gear is being used aboard ships of the transport and fishing fleet, oceanographic and hydrographic vessels. The basic meteorological systems serially produced by the domestic industry for installation aboard ships, are discussed in this article. GRA

N73-16618# Scripps Institution of Oceanography, La Jolla, Calif.
WAVE AND TURBULENCE Final Report, 1 May - 31 Jul. 1972
Robert H. Stewart 31 Oct. 1972 63 p refs
(Contract N00014-72-C-0383; NR Proj. 061-209)
(AD-751110; SIO-Ref-72-80) Avail: NTIS CSCL 04/2

Contents: Remote probing of turbulence in stable layers; Turbulent transport and structure in the boundary layer; Larger scale interactions and predictions; Effects on E and M propagation; Interactions of waves and turbulence; Theoretical and experimental analyses of stability criteria; Laboratory experiments. GRA

N73-16619# GCA Corp., Bedford, Mass. Technology Div.
TESTING AND OPERATION OF AEROSOL COUNTER ON TETHERED BALLOON FIGHTS Final Report, 15 Oct. 1971 - 15 Sep. 1972
Henry A. Miranda, Jr. Sep. 1972 30 p ref
(Contract F19628-72-C-0088; AF Proj. 7621)
(AD-751315; GCA-TR-72-A; AFCRL-72-0590) Avail: NTIS CSCL 04/2

The report describes continued work performed on the GCA balloon-borne aerosol counter. The unit was successfully operated in a series of tethered balloon flights which were conducted to obtain diagnostic data for overall system development purposes. Preliminary data reductions indicate reasonably good correlation with an airborne Royco counter operated as close to the balloon as possible. However, the size distribution exhibits a somewhat unusual peak at about 0.3-0.4 micron which is as yet unexplained. Author (GRA)

N73-16620# Hawaii Univ., Honolulu. Dept. of Meteorology.
THE MEAN WINDS OF THE UPPER TROPOSPHERE OVER THE CENTRAL AND EASTERN PACIFIC
James C. Sadler Jun. 1972 119 p refs
(Contracts N62306-69-C-0218; N00188-71-M-6783)
(AD-751579; UHMET-72-04;
ENVPREDRSCHFAC-Tech-Paper-8-72) Avail: NTIS CSCL 04/2

Analyses of mean monthly upper-tropospheric winds for the 200-, 250- and 300-mb levels are presented for the eastern and central Pacific region. Analyses are based on 9 years of PIREP winds measured on commercial jet aircraft as well as rawins from fixed stations. The upper troposphere is discussed in terms of its major features and their changes from month to month. Author (GRA)

N73-16621# Army Tropic Test Center, APO New York 09827.
EVAPORIMETRY IN THE CANAL ZONE. PART 1: CLIMATOLOGICAL MEASUREMENTS OF EVAPORATION Special Report, 1965 - 1969
Wilfried H. Portig Apr. 1972 30 p refs
(ARPA Order 740; DA Proj. 2M0-25001-A-724)
(AD-751782; USATTC-7204004-Pt-1) Avail: NTIS CSCL 04/2

The United States Army Tropic Test Center made measurements of 24-hour totals of evaporation during conduct of the Environmental Data Base Project in the Panama Canal Zone from 1965 to 1969. In the report measurements obtained with Piche evaporimeters are compared with those made simultaneously with the Standard Pan at the same locations. The annual variation of the measurements is presented for open terrain as well as for different heights in and above a forest. Author (GRA)

N73-16622# Naval Postgraduate School, Monterey, Calif.
LABORATORY EXPERMIMENTS ON WARM FOG DISSIPATION M.S. Thesis
Michael Joseph Marchetti Sep. 1972 55 p refs
(AD-751635) Avail: NTIS CSCL 04/2

Some of the more recent results of studies involving the use of hygroscopic materials and ionic surfactants as warm fog dispersants are covered in a brief survey of the literature. The fog chamber, equipment and experimental procedures used in this study are described in detail. Seeding agents used during these small-scale fog chamber experiments were limited to the use of hygroscopic materials, surfactants and ethyl alcohol. Results indicated that those hygroscopic agents tested, such as NaCl and glycerin, proved to be relatively effective warm fog dispersants compared to distilled water. The ionic and nonionic surfactants tested dissipated warm fog at approximately the same rate as distilled water and were considered ineffective. Ethyl alcohol appeared to initially increase the fog intensity, and thus, retard fog dissipation. Conductivity/Resistivity measurements and illustrations of the relative droplet sizes and shapes of the various agents used are also contained in this report. The effects on plants of four of the hygroscopic agents are also discussed and illustrated. Author (GRA)

N73-16394* California Univ., Riverside. Dept. of Geography.
CLIMATOLOGY OF URBAN-REGIONAL SYSTEMS
Robert W. Pease *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 224-240 refs (For availability see N73-16382 07-13)
CSCL 04B

N73-16964 State Univ. of New York, Albany. Atmospheric Sciences Research Center.
REMARKS ON THE USE OF CONDENSATION NUCLEI MEASUREMENTS
J. Podzimek *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 195-212 refs (For availability see N73-16950 07-34)

N73-16965 Genoa Univ. (Italy). Inst. for Geophysics and Geodesy.
SOLAR FLARE CONTROL OF THUNDERSTORM ACTIVITY
M. Bossolasco, I. Dagnino, A. Elena, and G. Flocchini *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 213-218 refs (For availability see N73-16950 07-34)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-16623 Stanford Univ., Calif.
THE READOUT AXIS STABILITY OF ELASTIC NEARLY

SPHERICAL GYRO ROTORS Ph.D. Thesis
William Norman Blanchard 1972 134 p
Avail: Univ. Microfilms Order No. 72-16690

A model of the elastic nearly spherical rotor is developed, which assumes that the nonspinning rotor is a perfect sphere, with additional point masses or holes of negative mass on its surface. These added masses represent the inertia nonsphericity and possible anisotropy of the rotor. A systematic technique based on measured rotor inertia properties is presented for determining the magnitude and location of the masses that are necessary to model an arbitrary nearly spherical rotor. Using the point mass model, the dependence of readout axis location on rotor spin speed and temperature is calculated. The model predicts that spin speed dependent changes are caused almost entirely by mass-unbalance torques acting on the rotor. In the absence of these disturbing moments, the readout axis orientation remains extremely stable. Dissert. Abstr.

N73-16624 Auburn Univ., Ala.
GENERAL STUDY OF THE ROTATIONAL MOTION OF AN ORBITING RIGID BODY ABOUT ITS CENTER OF MASS UNDER THE INFLUENCE OF CONSERVATIVE AND NONCONSERVATIVE TORQUES Ph.D. Thesis
Joseph Jeng Fu Liu 1971 168 p
Avail: Univ. Microfilms Order No. 72-12497

The variational equations, derived by Crenshaw and Fitzpatrick for studying the effects of either conservative and nonconservative perturbing torques on the attitude motion of a tumbling unaxial rigid satellite in a precessing orbit, are extended to apply to triaxial bodies. These equations, which are in a particularly convenient form for use in either numerical or analytical investigations, are then used to study two problems. The first problem examined is that of describing the complete rotational motions, about its center of mass, of a gravity-perturbed, rapidly spinning, triaxial satellite which moves in a precessing elliptic orbit about an attracting point mass. The second problem is the same as the first except that the gravity perturbation is replaced by an atmospheric perturbation. Dissert. Abstr.

N73-16625 Stanford Univ., Calif.
BEHAVIOR OF A COMPOUND PENDULUM AND A GYROSCOPE IN AN ARTIFICAL SATELLITE Ph.D. Thesis
Saleh Abdulraham Athel 1971 206 p
Avail: Univ. Microfilms Order No. 72-11501

The behavior of a compound pendulum and a two-gimbal gyroscope inside an artificial satellite, the mass center of which is presumed to move in a circular orbit while the satellite rotates at a constant rate about the normal to the orbit plane is discussed. The equation of motion of a rigid body which is constrained to rotate about an axis fixed in an artificial satellite is derived, and particular solutions of this equation are discussed. Two illustrative examples indicate possible uses of such a system as a device for establishing an attitude reference or for detecting variations in satellite rotation rates. The equations of motion of a two-gimbal gyroscope inside a rotating artificial satellite are derived; the mathematical equivalence of the problems of a gyroscope with a driven and a free rotor is established; and it is shown, under certain conditions, there exist approximate solutions describing motions during which the spin-axis of the rotor remains nearly fixed in inertial space. Dissert. Abstr.

N73-16626*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
GUIDANCE SYSTEM OPERATIONS PLAN FOR MANNED CSM EARTH ORBITAL AND LUNAR MISSIONS USING PROGRAM COLOSSUS 3. SECTION 7: ERASABLE MEMORY PROGRAMS
Margret H. Hamilton Oct. 1972 97 p
(Contract NAS9-4065; DSR Proj. 55-23890)
(NASA-CR-128689; R-577-Rev-01) Avail: NTIS HC $7.00 CSCL 17G

Erasable-memory programs designed for guidance computers used in command and lunar modules are presented. The purpose, functional description, assumptions, restrictions, and imitations are given for each program. F.O.S.

N73-16627# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TASK 2, IMPROVED DVOR LOW LEVEL RECEIVER MAINTENANCE SIMULATION Final Report, Apr. 1971 - Apr. 1972
Barry S. Brayer Jan. 1973 56 p
(FAA Proj. 042-307-02X)
(FAA-RD-72-67; FAA-ND-72-46) Avail: NTIS HC $5.00

This report discusses system performance with Single Sideband Doppler VOR (SSDVOR) and Double Sideband Doppler VOR (DSDVOR) as indicated by low level or receiver maintenance through simulation of detuned intermediate frequency amplifier stages. The simulation was accomplished by shifting the carrier frequency of the Doppler VOR transmitter. Indicated bearing error on 10 VOR receivers was recorded during tests at the National Aviation Facilities Experimental Center. Based on the simulation test results it was concluded that the DSDVOR system provides less course error than the SSDVOR system, and that careful alignment of the receiver on the particular DVOR channel frequency minimizes course error. Author

N73-16628# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
INVESTIGATIONS OF MLS CONVENTIONAL AND DOPPLER SCANNING BEAM TECHNIQUES Final Report, Jun. 1971 - Sep. 1972
J. Beneke, C. W. Wightman, H. D. Becker, and C. E. Kassel Sep. 1972 182 p refs
(Contract DOT-FA71WA-2592)
(AG-5011-B-1; FAA-RD-72-124) Avail: NTIS HC $11.25

The results of analytical and experimental investigations carried out in support of the Microwave Landing System (MLS) program of the Federal Aviation Administration are summarized. The experimental program consisted of a simulation of the MLS signals that would be received in an aircraft. The systems simulated included conventional scanning beams with frequency and pulse angle coding, step-scan beams with frequency and time interval coding and the Doppler scan technique. Angle measurement errors were determined for a wide range of signal parameters. Errors were measured in the presence of a single multipath of variable characteristics. Conclusions were drawn concerning the capability of the several signal formats to meet certain accuracy requirements. The need for special processing techniques to reduce the effects of multipath is discussed. Author

N73-16629# IIT Research Inst., Annapolis, Md.
AIR TRAFFIC CONTROL SYSTEMS INTERFERENCE CONSIDERATIONS Final Report
F. Tabor and J. Shields Mar. 1972 53 p refs
(Contract DOT-FA70WAI-175; FAA Proj. 213-516-035)
(ECAC-PR-72-008; FAA-RD-72-20) Avail: NTIS HC $4.75

The FAA Air Traffic Control Navigation/Communications system is examined to identify areas within the system that are particularly susceptible to radio frequency interference effects. The identified areas are investigated in the light of known past and present analyses, and recommendations for further studies are made. The report concludes that the cosite aspects of the FAA VHF communications system requires further study in order to derive a practical means for achieving electromagnetic compatibility in the future. Author

N73-16630# IIT Research Inst., Annapolis, Md.
ATCRBS PERFORMANCE ANALYSIS FOR NEW YORK AIR ROUTE TRAFFIC CONTROL CENTER Final Report
Charles A. Gettier Jul. 1972 47 p refs
(Contract DOT-FA70WAI-175; FAA Proj. 213-503-015)
(ECAC-PR-72-031; FAA-RD-72-35) Avail: NTIS HC $4.50

The occurrence of excessive interrogation signals (hot spots) within air traffic control sectors supervised by the Air Traffic Control Beacon System (ATCRBS) of the Federal Aviation Administration is evaluated. On-site observations of air traffic displays are discussed, and the analyses of the air traffic electromagnetic environments using performance prediction model techniques are described. Each of the studies evaluates the possibility of hot spots affecting one of the following ATCRBS Air Route Traffic Control Centers: Jacksonville, Washington, New York, Kansas City, and Los Angeles. Author

N73-16631# California Univ., Livermore. Lawrence Livermore Lab.
TEST RESULT OF THE GEOGRAPHIC POSITION LOCATOR:

A SYSTEM FOR IMPROVING LAND NAVIGATION WITHOUT EXTERNAL AIDS
John D. Salisbury 21 Jul. 1972 40 p refs Presented at 6th Biennial Guidance Test Symp., Holloman AFB, N. Mex., 4 Oct. 1972 Sponsored jointly by AEC and DoD
(UCRL-74039; Conf-721005-1) Avail: NTIS

Navigation-accuracy test results for the GPL experimental system, GPL-A are presented. The Geographic Position Locator (GPL) - a small, self-contained unaided system for accurate, long-term, land-based inertial navigation, is described. Particular emphasis is placed on the means for automatically reducing its position errors. Use is made of the normal rest periods of land-based systems to reduce system errors and improve the subsequent navigational accuracy. Operation can be fully automatic, with a motion-state sensor being used to activate the error-reduction process during stationary periods. Stored map information, for automatic comparison with computed position, and selective response based on the comparison also could be part of a class of fully-automated GPL systems. Author

N73-16632# German Air Traffic Controller's Association, Langenhagen (West Germany).
AIR TRAFFIC CONTROL PROBLEMS FROM THE CONTROLLER'S POINT OF VIEW [FLUGSICHERUNGSPROBLEME AUS DER SICHT DER FLUGLOTSEN]
Wolfgang Kassebohm 1972 7 p In GERMAN Presented at the DGLB Symp. on Flugbetrieb, Cologne, 15 Sep. 1972
(DGLR-Paper-72-038) Avail: NTIS HC $3.00

The problems of air traffic control due to the increasing volume of air traffic are discussed. A solution is suggested which consists of a basic reform of air traffic law, and a central government authority responsible for all safety regulations.
Author (ESRO)

N73-16633# Naval Postgraduate School, Monterey, Calif.
OPTIMIZATION OF THE SHORT RANGE WEAPONS CONTROL SYSTEM M.S. Thesis
James Warren Allen Jun. 1972 43 p refs
(AD-751654) Avail: NTIS CSCL 17/7

The report deals with the evaluation of the performance of a strapped down air-to-air tracker for the Short Range Weapons Control System. The system was designed, built, and evaluated at the Naval Weapons Center. The subsystems of the tracker which contributed to the problem areas discovered by flight tests are described. An evaluation of the shortcomings of the tracking scan mode and the automatic gain control circuit is discussed and circuit modifications are proposed which include a collapsing square scan for target tracking and a variable width window discriminator. Author (GRA)

N73-16634# Mitre Corp., Bedford, Mass.
UNDERSTANDING KALMAN FILTERING AND ITS APPLICATION IN REAL TIME TRACKING SYSTEMS
J. J. Burke Jul. 1972 70 p refs
(Contract F19628-71-C-0002; AF Proj. 4510)
(AD-751485; MTR-2417; ESD-TR-72-312) Avail: NTIS CSCL 17/7

The theory and applications of Kalman filtering have now been under development for over a decade. Kalman filtering is currently being used operationally in numerous applications such as satellite tracking systems, aircraft navigational systems and aircraft tracking systems. Because Kalman filtering is a statistical concept that is typically described in terms of state-space notation, project managers and engineers must frequently accept an abstruse set of equations while feeling insufficiently qualified to appreciate their significance or applicability. In spite of the obscure terminology and associated matrix notation that typically accompanies any discussion of Kalman filtering, the salient features of the theory are relatively straightforward and can be presented in a manner that appeals to intuition. The paper represents such an attempt with emphasis on applications to real time tracking systems. Author (GRA)

N73-16635# Human Factors Research, Inc., Santa Barbara, Calif.
THE LANDING SIGNAL OFFICER: DISPLAY REQUIREMENTS FOR ACLS RECOVERIES Final Technical Report
Albert Harabedian, Gail J. Borden, and Gene R. Kelley Sep. 1972 85 p refs
(Contract N00014-71-C-0258; NR Proj. 215-190)
(AD-751076; Rept-1720-F) Avail: NTIS CSCL 17/7

A description of a study to determine the information displays required by LSOs to effectively control aircraft in the Automatic Carrier Landing System environment is presented. Dangerous and safe approaches were flown in an F-4B aircraft simulator. Displays of selected information about the aircraft's performance during the approaches were produced with a computer and recorded on motion picture film. The information displays were integrated Glide-Slope and Line-Up deviations. Range, Airspeed, Power, Angle of Attack, and Sink-Rate. Groups of LSOs viewed the different display combinations. The LSO's task was to wave-off the aircraft if he judged the approach to be dangerous. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-16636 Cornell Univ., New York.
THE DESIGN, MODELING, AND OPTIMIZATION OF A SPACE ORIENTED RADIOISOTOPE THERMOELECTRIC POWER SUPPLY Ph.D. Thesis
Alan Weg Schorr 1971 103 p
Avail: Univ. Microfilms Order No. 72-9935

The design, modeling, and optimization of a radioisotope fueled thermoelectric generator is carried out analytically to obtain the lowest weight, highest efficiency generator. The generator has basically a cylindrical configuration and is designed to operate in space and provide on the order of a hundred watts of electric power. Thermocouples are placed cylindrically about the fuel capsule and are heated by radiation alone. The equations describing the thermal-electric model of the generator and fuel capsule are developed. The entire system is optimized using the method of constrained steepest descent to minimize the function f = S2 (1/specific power) + S3 (1/efficiency). Results of the optimization have yielded generators with performance increases of 15 percent in efficiency and of 26 percent in specific power over the General Electric baseline design. The maximum design efficiency obtained is 9.5 percent and the maximum specific power is 4.06 watts/pound for the constraints considered.
Dissert. Abstr.

N73-16637# Research Inst. of National Defence, Stockholm (Sweden).
TRANSURANIC ELEMENTS, PRESENT AND FUTURE
L. Wallin Jun. 1971 71 p refs In SWEDISH
(FOA-4-C-4463-22(13)) Avail: NTIS HC $5.75

Transuranic elements, which are formed in the process of nuclear reactions, have already found important applications in medicine and scientific research. The report presents a number of examples of actual and potential uses gathered from widely different areas. A summary of production methods is discussed (in power and breeding reactors and in nuclear explosions), as well as present day and future production programs and requirements, and the costs for some of the most important transuranic elements. Author

N73-16638*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORETICAL ANALYSIS OF SWELLING CHARACTERISTICS OF CYLINDRICAL URANIUM DIOXIDE FUEL PINS WITH A NIOBIUM - 1-PERCENT-ZIRCONIUM CLAD
James F. Saltsman Washington Feb. 1973 45 p refs
(NASA-TM-X-2717; E-7135) Avail: NTIS HC $3.00 CSCL 18J

The relations between clad creep strain and fuel volume swelling are shown for cylindrical UO2 fuel pins with a Nb-1Zr clad. These relations were obtained by using the computer code CYGRO-2. These clad-strain - fuel-volume-swelling relations may be used with any fuel-volume-swelling model, provided the fuel

volume swelling is isotropic and independent of the clad restraints. The effects of clad temperature (over a range from 118 to 1642 K (2010 to 2960 R)), pin diameter, clad thickness and central hole size in the fuel have been investigated. In all calculations the irradiation time was 500 hours. The burnup rate was varied. Author

N73-16639*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATION OF EXPERIMENTAL PERFORMANCE DATA FOR A CVD TUNGSTEN-NIOBIUM, PLANAR THERMIONIC CONVERTER
Peter M. Sockol Washington Feb. 1973 14 p refs
(NASA-TM-X-2716; E-7194) Avail: NTIS HC $3.00 CSCL 18I

Approximate expressions are presented which correlate experimental performance data from a CVD tungsten-niobium, planar thermionic converter. The current voltage characteristics are given as functions of emitter and collector temperatures and cesium pressure for currents below the knee in the ignited mode. The correlation covers the temperature ranges of 1700 to 1950 K for the emitter, 900 to 1050 K for the collector, and 580 to 645 K for the cesium reservoir. Author

N73-16640# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
FMODEL: A FORTRAN 4 COMPUTER CODE TO PREDICT IN-REACTOR BEHAVIOR OF LMFBR FUEL PINS
F. J. Homan, W. J. Lackey, and C. M. Cox Jan. 1973 106 p refs
(Contract W-7405-eng-26)
(ONRL-4825) Avail: NTIS HC $7.50

A computer code to predict the in-reactor behavior of stainless steel clad (U,Pu)02 fuel pins is described. The code is an integration of three complex models describing the thermal, mechanical, and chemical performance of LMFBR-type fuel pins. This report is intended to serve two purposes: (1) to acquaint the casual reader with the general methodology used in the code, and to provide comparison between predicted fuel pin performance and performance measured directly from irradiation experiments; and (2) to serve as a user's guide. Detailed accounts of individual models, glossaries of variable names, and descriptions of individual subroutines are contained as appendices. Author

N73-16641*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN 810 FT/SEC SOIL IMPACT TEST OF A 2-FOOT DIAMETER MODEL NUCLEAR REACTOR CONTAINMENT SYSTEM
Richard L. Puthoff Dec. 1972 22 p refs
(NASA-TM-X-68180; E-7275) Avail: NTIS HC $3.25 CSCL 18J

A soil impact test was conducted on a 880-pound 2-foot diameter sphere model. The impact area consisted of back filled desert earth and rock. The impact generated a crater 5 feet in diameter by 5 feet deep. It buried itself a total of 15 feet - as measured to the bottom of the model. After impact the containment vessel was pressure checked. No leaks were detected nor cracks observed. Author

N73-16642*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POST IMPACT BEHAVIOR OF MOBILE REACTOR CORE CONTAINMENT SYSTEMS
Richard L. Puthoff, W. G. Parker (Westinghouse Electric Corp., Pittsburgh), and L. E. VanBibber (Westinghouse Electric Corp., Pittsburgh) 1972 31 p refs Presented at the Ann. Meeting of the Am. Nucl. Soc., Las Vegas, Nev., 18-22 Jun. 1972
(NASA-TM-X-68176; L-6283) Avail: NTIS HC $3.75 CSCL 18J

The reactor core containment vessel temperatures after impact, and the design variables that affect the post impact survival of the system are analyzed. The heat transfer analysis includes conduction, radiation, and convection in addition to the core material heats of fusion and vaporization under partially burial conditions. Also, included is the fact that fission products vaporize and transport radially outward and condense outward and condense on cooler surfaces, resulting in a moving heat source. A computer program entitled Executive Subroutines for Afterheat Temperature Analysis (ESATA) was written to consider this complex heat transfer analysis. Seven cases were calculated of a reactor power system capable of delivering up to 300 MW of thermal power to a nuclear airplane. Author

N73-16643# Mound Lab., Miamisburg, Ohio.
ISOTOPIC POWER FUELS PROGRAMS, JANUARY - MARCH 1972
30 Jun. 1972 28 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1905) Avail: NTIS

Research and development progress is reported on plutonium dioxide-molybdenum cermet (PMC) fuels, pacemaker fuel, pressed plutonium dioxide (PPO) fuel spheres for the multihundred watt program, coating PMC spheres with Mo and W, impact stability of PPO spheres, powder blending for fabrication of PMC disks, parameters of PMC fueled heat sources, dissolution of plutonium dioxide, and analytical standards for contamination limits in TA-10 wt % W alloys. NSA

N73-16644# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
IN PILE RADIATION DAMAGE IN GRAPHITE. CORRELATION BETWEEN TEMPERATURE AND FLUX DENSITY IN THE RANGE OF HIGH TEMPERATURE
J. P. Genthon and G. Micaud 1972 3 p refs In FRENCH; ENGLISH summary Presented at Intern. Carbon Conf., Baden-Baden, West Ger., 26 Jun. 1972
(CEA-CONF-1894; Conf-720609-4) Avail: AEC Depository Libraries

A series of in pile irradiation experiments with graphite confirm and define a model; this model is defined by a displacement zone structure of elementary defects induced by one neutron collision. It was concluded that monovacancies were not present but the existence (possibly among others) of a defect of activation energy Q = 4 eV (which may be a divacancy) was confirmed. This value Q = 4 eV is suggested for the classic adjustment of equivalent temperature in the interval 600 to 1400 C.
Author (NSA)

N73-16645# Atomic Energy Establishment, Winfrith (England).
EFFECT OF CRUD DEPOSITS ON FRICTIONAL PRESSURE DROP IN A BOILING CHANNEL
R. V. Macbeth Apr. 1972 15 p refs
(AEEW-R-767) Avail: AEC Depository Libraries

Pressure drop data are examined which were obtained using annular test sections with the central heated rod first in a clean condition and subsequently covered with a layer of crud, typical of the deposits that occur in boiling channels. The tests were done with water at 69 bar and with a wide range of mass velocities, inlet subcooling and heat flux levels. The results show that frictional pressure drop is increased about 40% by the presence of crud when no boiling takes place. With boiling however, the frictional pressure drop in a crudded channel is shown to be only slightly higher than in a corresponding clean channel. This effect is due to the fact that in a boiling channel a large proportion of the total friction can be generated by the drag forces accelerating the entrained liquid in the vapour stream. These drag forces are largely independent of whether the channel is clean or crudded and hence, only a slight difference may be found in the frictional pressure drop values. Author (NSA)

N73-16646# Los Alamos Scientific Lab., N.Mex.
THE SPACE ELECTRIC POWER R AND D PROGRAM Quarterly Report, period ending 31 Jul. 1972
Aug. 1972 13 p refs
(Contract W-7405-eng-36)
(LA-5021-PR) Avail: NTIS

Five ceramic-metal multilayers have been fabricated for inclusion in the Experimental Breeder Reactor (EBR-II) and are being assembled into Isothermal Irradiator Capsule K-5, together with 11 specimens from Gulf General Atomic Co. (GGA). Difficulties in testing the heat pipe for this capsule have been overcome, and tests of the prototype unit show that, with the pipe operating at 745 C, a threefold increase in power transmitted down the pipe increases the operating temperature by approximately 30 C. Guard-ring measurements of the specific resistance

of yttria that has been incorporated into a Nb-1% Zr sheathed trilayer unit by plasma-arc spraying and subsequent autoclaving indicate that at 750 C an electric field of 400 V/cm causes the resistance to decrease with time. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-16647 Cornell Univ., Ithaca, N.Y.
INTERACTION OF AN INTENSE RELATIVISTIC ELECTRON BEAM WITH AXIAL AND CONVERGENT MAGNETIC GUIDE FIELDS Ph.D. Thesis
John Joseph Bzura 1971 152 p refs
Avail: Univ. Microfilms Order No. 72-13148

The components and operating principles of a 500 kilovolt, 100 kiloampere (nominal), 50 nanosecond pulse duration electron accelerator are discussed. Design considerations and the final form of the capacitor bank-magnetic field assembly are presented in detail. Operation of a high-field-emission diode immersed in strong axial magnetic fields (2-10 kilogauss) is shown to produce certain benefits concurrent with minor anode problems. Corrective solutions to these problems are discussed. Experiments on beam interaction with several types of gradient magnetic fields were performed to investigate beam focusing via converging magnetic field lines. The results of the first experimental configuration discussed show that 3:1 reduction in beam diameter is possible at a cost of high initial losses. Other configurations examined include a more efficient arrangement with a smaller reduction factor, an extremely strong convergent gradient, and a divergent field experiment. Beam extraction is discussed in the last case. Dissert. Abstr.

N73-16648 Stanford Univ., Calif.
SCANNED ACOUSTICAL IMAGING AT MICROWAVE FREQUENCIES Ph.D. Thesis
Denis Conrad Webb 1972 160 p
Avail: Univ. Microfilms Order No. 72-16814

The design, construction, and evaluation of a scanning acoustical microscope system to operate at a frequency of 1 GHz are discussed. To avoid the problems encountered in scanning a focused acoustic beam, a negative receiver scan system was devised. Here the object is uniformly illuminated with acoustic radiation and its shadow cast upon a photoconductive transducer. The image information is obtained by scanning the transducer with a focused light spot which effectively deactivates the illuminated area. The change in electrical signal output from the transducer during the scan is a measure of the relative acoustic intensity intercepted by the light spot. This change is used to intensity modulate a CRT which is scanned synchronously with the light beam, thus producing an ordinary TV type picture. The technique was successfully employed to visualize acoustic interference patterns on the endface of a many wavelengths long acoustic resonator, thus verifying the impaging principle. Dissert. Abstr.

N73-16649 Stanford Univ., Calif.
TIME VARIANT AND MICROWAVE ACOUSTIC SIGNAL PROCESSING Ph.D. Thesis
Gene Chao 1971 108 p
Avail: Univ. Microfilms Order No. 72-11523

The propagation of a wave in a uniform distributed medium whose impedance is discontinuous in time is investigated. The reflection and transmission coefficients are derived for a single time discontinuity, and the transfer characteristics of a sequence of time discontinuities are analyzed by scattering and cascading matrices. A synthesis procedure is established by which the transfer characteristics of time-variant distributed networks may be specified. A parametric surface-wave amplifier is described. A study is also made of the focusing and scanning of acoustic beams using Fresnel zone plate lenses. Basic properties of Fresnel zone plates are derived, and intensity distributions along the lens axis and in a plane normal to the axis are presented. Experiments are conducted with fixed and photoconductively controlled acoustic Fresnel zone plate radiators. The behavior of piezoelectric, photoconductive sulfide cadmium films are described. Dissert. Abstr.

N73-16650 Texas Univ., Austin.
AN ANALYSIS OF THE PARAMETRIC ACOUSTIC ARRAY FOR SPHERICAL WAVE FIELDS Ph.D. Thesis
Thomas Gustave Muir, Jr. 1971 168 p
Avail: Univ. Microfilms Order No. 72-11395

The nonlinear interaction of two collinear acoustic waves to produce a modulation product in the lower sideband is examined both theoretically and experimentally. The modulation takes place in a collimated zone of interaction in a portion of the medium normal to the electroacoustic source. The theoretical approach of Westervelt is used to obtain solutions for interacting fields composed of monochromatic spherical waves. Beam pattern and sound propagation data resulting from several hydroacoustic experiments conducted in a fresh water lake are presented to demonstrate the validity of the numerical solution. The theory is also extended to describe the transient response of the parametric array to pulsed carriers. The existence of nonlinear transients, created by the interaction of sideband energy in the Fourier spectra of the carrier pulses, is predicted and confirmed experimentally. Dissert. Abstr.

N73-16651# Ultrasystems, Inc., Newport Beach, Calif.
THE EFFECTS OF LOCAL METEOROLOGICAL FACTORS UPON AIRCRAFT NOISE MEASUREMENTS Final Report, Aug. - Nov. 1972
D. C. Wooten and R. L. Eidemiller 12 Nov. 1972 47 p refs
(Contract DOT-FA73WI-0382-1)
(FAA-RD-72-145) Avail: NTIS HC $4.50

Aircraft noise measurements from the Boeing 737, made at Orange County Airport, Santa Ana, California, during operational conditions, are statistically correlated with the local meteorological factors including wind force and direction, temperature, humidity barometric pressure, ceiling and visibility. The correlation was carried out using regression techniques and indicated that there is a significant inverse correlation between temperature and noise level. Wind speed appeared to be of significance in one calculation that included wind speeds up to 25 knots, but was not significant when the range of wind speeds was 15 knots and below. Author

N73-16652# Defence Research Establishment Ottawa (Ontario).
SOME PROBLEMS IN IRLS NOISE PATTERN IDENTIFICATION
B. G. Young Oct. 1972 17 p
(DRE Proj. 38-80-07)
(DREO-TN-72-25) Avail: NTIS HC $3.00

Techniques are presented which assist the interpreter to identify pulse noise sources which generate patterns on infrared line scan imagery. These techniques are illustrated by two examples: Tacan pulses on Reconofax XIII A imagery, and search radar pulses on Firemapper imagery. Author

N73-16653*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EMISSION OF SOUND FROM TURBULENCE CONVECTED BY A PARALLEL FLOW IN THE PRESENCE OF SOLID BOUNDARIES
Marvin E. Goldstein and Burt M. Rosenbaum Washington Feb. 1973 92 p refs
(NASA-TN-D-7118; E-6932) Avail: NTIS HC $3.00 CSCL 20A

A theoretical description is given of the sound emitted from an arbitrary point in a parallel or nearly parallel turbulent shear flow confined to a region near solid boundaries. The analysis begins with Lighthill's formulation of aerodynamic noise and assumes that the turbulence is axisymmetric. Specific results are obtained for the sound emitted from an arbitrary point in a turbulent flow within a semi-infinite, open-ended duct. Author

N73-16654*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW ASPECTS OF SUBSONIC AERODYNAMIC NOISE THEORY

Marvin E. Goldstein and Walton L. Howes Washington Feb. 1973 40 p refs
(NASA-TN-D-7158; E-7047) Avail: NTIS HC $3.00 CSCL 20A

A theory of aerodynamic noise is presented which differs from Lighthill's theory primarily in the way in which convection of the noise sources is treated. The sound directivity pattern obtained from the present theory agrees better with jet-noise directivity data than does that obtained from Lighthill's theory. The results imply that the shear-noise contribution to jet noise is smaller than previously expected. Author

N73-16655*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF NOZZLE INLET SHAPE, LIP THICKNESS, AND EXIT SHAPE AND SIZE ON SUBSONIC JET NOISE
W. A. Olsen, O. A. Gutierrez, and R. G. Dorsch 1973 28 p refs Presented at 11th Aerospace Sci. Meeting, Washington, D. C., 10-12 Jan. 1973; sponsored by Am. Inst. of Aeron. and Astronaut.
(NASA-TM-X-68182; E-7289) Avail: NTIS HC $3.50 CSCL 20A

Far field noise data were taken for convergent nozzles of various shapes and sizes at subsonic velocities exceeding 400 feet per second. For a circular nozzle, the nozzle inlet shape and lip thickness had no effect on the noise level, directivity, or spectra when compared at the same nozzle exit diameter and peak exhaust velocity. A sharp edged orifice was one exception to this statement. Coannular nozzles can produce additional high frequency noise. Blunt ended centerbodies, where there is significant base drag, also generate significant additional noise. The total noise power generation was essentially the same for circular, slot, and plug nozzles of good aerodynamic shape. The noise radiation patterns were essentially the same for these nozzle shapes except near the nozzle exhaust axis. Author

N73-16656# McElroy (Ralph) Co., Austin, Tex.
EMITTING MATERIALS: STATE OF AFFAIRS OF A VERY PROMISING TECHNIQUE: THE ACOUSTIC EMISSION ANALYSIS
J. C. F. DeKanter Aug. 1972 73 p refs Transl. into ENGLISH of "Sprekend Materiaal: Stand van Zaren Van Een Veelbelovende Techniek De Akoestische Emissie Analyse", Tech. Hogeschool Delft, report, Fall 1971 Sponsored by AEC Prepared for Dow Chem. Co., Golden, Colo.
(RFP-Trans-101) Avail: NTIS

Information is included on acoustic emission sources, detection and discrimination of acoustic emission signals, signal interpretation, use of acoustic emission signals in analysis of crack initiation and propagation, uses of acoustic emission signals in non-destructive testing, and a review of activities at various laboratories. NSA

N73-16657# Institut Franco-Allemand de Recherches, St. Louis (France).
OBTAINMENT OF AN ULTRA-RAPID, DENSE PLASMA STREAM FROM THE EXPLOSION OF A LITHIUM WIRE. APPLICATION TO METEORITES AND IMPACT PHYSICS SIMULATION Ph.D. Thesis - Nancy Univ. [SUR L'OBTENTION D'UN JET ULTRA-RAPIDE DE PLASMA DENSE D'EXPLOSION DE FIL DE LITHIUM. APPLICATIONS A LA SIMULATION DES METEORITES ET EN PHYSIQUE DES IMPACTS]
G. Herbette 1 Oct. 1971 128 p refs In FRENCH
(ISL-26/71) Avail: NTIS HC $8.50

A technique based on exploding wire plasma acceleration to produce hypervelocity particles for simulation of micrometeoritic damage at impact is described, and its theoretical principles are reviewed. The experimental results obtained by accelerating solid particles using a plasma jet are outlined. Some applications to the study of micrometeorites and to impact physics, as well as methods used to measure accelerated particle velocities, are also discussed. ESRO

N73-16658# Institut Franco-Allemand de Recherches, St. Louis (France).
STUDY OF THE SENSITIVITY OF NITROGLYCERIN TO WEAK SHOCK WAVES (SUPERSONIC AIRCRAFT BANGS) [UNTERSUCHUNG DER EMPFINDLICHKEIT VON NITROGLYCERIN GEGEN SCHWACHE STOSSWELLEN (FLUGZEUGKNALL)]
H. W. Koch, I. Bischoff, and L. Philipp 27 Apr. 1972 19 p refs In GERMAN
(ISL-14/72) Avail: NTIS HC $3.00

The resistance of nitroglycerin to weak shock waves corresponding to the sonic boom caused by aircraft was examined. Tests were carried out in a sonic boom generator which produced shock waves with pressure gradients up to 50 mbar and a duration of 345 ms in order to investigate detonation risk under the sonic boom effect. Nitroglycerin samples in layers 6 mm thick, placed in a bowl covered with a thin plastic layer, were exposed to incident frontal waves. No detonation was observed either during these tests or during the same tests carried out with other primers. ESRO

N73-16659# Departement d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).
PROFILE AND DEPTH OF MICROCRATERS FORMED IN GLASS
J. C. Mandeville Dec. 1972 9 p refs
(ONERA-NT-01-14-72) Avail: NTIS HC $3.00

Borosilicate glass mirrors coated with 600 A aluminum film were impacted by spherical iron particles from a 2 million volt accelerator for studying optical characteristics of mirrors after hypervelocity projectile bombardment. By sectioning glass targets impacted by a large number of hypervelocity particles, it was possible to observe the profile of microcraters and to obtain a direct measurement of their depth. The crater depth to projectile diameter ratio is 1.30 for a 15 x 10 to the minus 12th power g iron projectile hitting the target at 6 km/s. The energy dispersive X-ray attachment to the scanning electron microscope shows that most of the projectile remains in the crater, up to 6 km/s impact velocities. Author (ESRO)

N73-16660# Arizona Univ., Tucson. Optical Sciences Center.
EVOLUTIONARY STUDIES OF PRECISION OPTICAL SYSTEMS Annual Report, 1 Sep. 1971 - 31 Aug. 1972
A. B. Meinel 1 Oct. 1972 34 p refs
(Contract F44620-69-C-0024)
(AD-751496; AFOSR-72-2142TR; AR-4) Avail: NTIS CSCL 20/6

Contents: Optical design concepts and techniques; Science and technology of optical materials; Structural mechanics; Quantum optics. GRA

N73-16661# Inventors and Investors, Inc., Williamstown, Mass.
THEORETICAL STUDIES OF ZONE PLATES MONOLITHICALLY INTEGRATED WITH SENSORS Final Report, 1 Aug. 1971 - 31 Jul. 1972
Kurt Lehovec and Andre Fedotowsky 31 Jul. 1972 138 p refs
(Contract F19628-71-C-0241; AF Proj. ILIR)
(AD-751516; AFCRL-72-0498) Avail: NTIS CSCL 20/6

The intensity distribution of radiation focussed by zone plate optics has been analyzed and the radiation flux on a sensor area centered about the optical axis computed. It is found that sensor response to a Lorentzian beam distribution depends substantially on the ratio of sensor radius to the product of the aperture radius and the spectral half width. Response of an axially located disk-shaped sensor to an oblique incident beam is computed. Combinations of a zone plate with a phase filter to produce an annular image are described, and application to spectral separation of a beam comprising two distinct wavelengths of suitable ratio is suggested. Integrated zone plate sensor configurations are proposed with emphasis on increasing the focal length by multiple reflections on the wafer surfaces. Numerical examples are computed for incident radiation of 1.15 micron wavelength using a Schottky barrier sensor on silicon. Structures to achieve both suppression of reflection losses and phase compensation are suggested. Insertion gains by at least an order of magnitude appear feasible for microsensors. Author (GRA)

N73-16662# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
UNDERWATER SOUND TRANSDUCER CALIBRATION

SYSTEM FOR THE 0.3 TO 2000 Hz FREQUENCY RANGE AT HYDROSTATIC PRESSURE TO 6.89 MPa Interim Report
Harris J. Hebert and Lynn P. Browder 20 Oct. 1972 19 p refs
(RF05111401)
(AD-751536; NRL-7502) Avail: NTIS CSCL 20/1

A controlled-environment system has been constructed to facilitate calibration of a wide variety of underwater sound transducers in the frequency range 0.3-2000 Hz at static pressure to 6.89 MPa (1000 lb/sq in) and temperature from -2 to -40C. The report describes electronic and mechanical features of the system, including active impedance termination, extension of frequency range upward to 2000 Hz, and automatic recording of end-of-cable sensitivity. Author (GRA)

N73-16663# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE THREE-DIMENSIONAL FREQUENCY SPECTRA OF PHOTOGRAPHIC IMAGES
M. Y. Shulman and I. M. Chaikina 12 Sep. 1972 11 p refs Transl. into ENGLISH from Zh. Nauchn. i Prikl. Fotogr. i Kinematogr. (Moscow), v. 16, 1971 p 180-182
(AF Proj. 7351)
(AD-751418; FTD-HT-23-843-72) Avail: NTIS CSCL 20/6

The use of a diffraction technique for determining the three dimensional frequency spectra (TFS) of photographic images of various objects usual in amateur photography is described. The TFS data are obtained with the aid of a computer by means of a program based on Fourier transforms of microphotometrically determined optical density distributions in the vicinity of the outlines of the image. GRA

N73-16664# Naval Training Device Center, Orlando, Fla. Physical Sciences Lab.
SYSTEMS ANALYSIS OF VIDICON OPTICS FOR THE ELECTRONIC PERISCOPE VIEW SIMULATOR
Frank J. Oharek Feb. 1972 31 p
(AD-751023; NAVTRADEVCEN-IH-183) Avail: NTIS CSCL 17/2

New, high resolution vidicon tubes are being developed for T.V. applications. The resolution requirements of one such tube are reviewed and the specialized optical probe required for an electronic periscope view simulator is analyzed. Conventional optical analysis, with the exception of pupil magnification, is used to show that desired system resolution can be attained if model scale is flexible. The graphical results indicate that an 800 scale aircraft carrier is usable if 25% resolution degradation over 40% of the length of the model is acceptable for the closest simulated range. If stricter resolution and depth of field requirements are desired than larger models must be used. Author (GRA)

N73-16959 Istituto Universitario Navale, Naples (Italy).
MEASUREMENTS OF SOUND WAVE ATTENUATION IN THE TYRRHENIAN SEA [MISURE DI ATTENUAZIONE DI IMPULSI SONORI NEL MARE TIRRENO]
E. Paolini *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 139-156 In ITALIAN Sponsored by CNR (For availability see N73-16950 07-34)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-16665*# Oak Ridge National Lab., Tenn.
COMPARISON OF THE RESULTS OF CALCULATIONS DONE AT DIFFERENT LABORATORIES WITH EACH OTHER AND WITH EXPERIMENTS ON THE SECONDARY PROTON AND NEUTRON SPECTRA FROM PROTONS AT 140 AND 160 MeV ON NUCLEI
H. W. Bertini 28 Jul. 1966 32 p refs
(NASA Order R-09-019-901)
(NASA-CR-130347) Avail: NTIS HC $3.75 CSCL 20H

Comparisons are illustrated between calculations on those parts of the secondary proton and neutron spectra that lie above about 20 MeV and that are measured at various angles. The interactions are 140- and 160-MeV protons on several elements ranging from aluminum to bismuth. The calculation that differs most from experimental results is probably the Brookhaven calculation, which is the latest and most detailed. The differences are apparently due to inclusion of reflection and refraction effects in the calculation. When these effects are not included, the results from all calculations are very similar. Author

N73-16666*# California Univ., Riverside. Dept. of Physics.
EARTH ALBEDO NEUTRONS FROM 10 TO 100 MeV
Alan M. Preszler, George M. Simnett, and R. Stephen White 1 Feb. 1972 19 p refs
(Grant NGR-05-008-022; Contracts N00014-69-A-0200-5001; N00014-69-A-0200-5004)
(NASA-CR-130019; TR-2; AD-740099; IGPP-UCR-72-1) Avail: NTIS HC $3.00 CSCL 20H

The measurement of the energy and angular distributions of earth albedo neutrons from 10 to 100 Mev is reported. Measurements were made at 40 N. geomagnetic latitude from a balloon at 120,000 ft. Fluxes of upward moving neutrons at angles of 20 deg to 70 deg to the vertical show that the lower energy neutrons are peaked near the vertical. The distributions are integrated over angle to give an omnidirectional energy distribution for upward moving neutrons that is flat to 50 Mev then decreases with energy. The absolute neutron flux is of the correct strength and the energy distributions of the correct shape for the albedo neutrons to be the sources of the protons trapped in the earth's inner radiation belt. Author

N73-16667# Tokyo Univ. of Education (Japan). Dept. of Physics.
DIFFRACTIVE PRODUCTIONS AND LEVEL DENSITY OF MESON RESONANCES IN THE RELATIVISTIC EXTENDED QUARK MODEL AND MISSING-MASS SPECTRA OBSERVED IN PION(MINUS) PROTON YIELDS PROTON x(MINUS)
Tsunehiro Kobayashi and Nobuyuki Nakamaru Sep. 1972 14 p refs
(TUEP-72-41) Avail: NTIS HC $3.00

Missing-mass spectra observed in negative pion proton yields proton negative x are investigated in terms of the quark model with a relativistically extended internal structure. It is shown that resonance production term of recent data at 25 and 40 GeV/c can be well reproduced by this model. Predictions of diffractive productions of A sub 2 (1310) and A sub 3 (1690) resonances are also shown to fit present experimental data. It is found that the relativistically extended internal structure plays an important role to derive these results in the model. Author

N73-16668# Tokyo Univ. of Education (Japan). Dept. of Physics.
REGGE PHENOMENOLOGY IN THE CENTRAL REGION
Sunao Sakai 1972 11 p refs
(TUEP-72-46) Avail: NTIS HC $3.00

The model proposed to explain the phenomena in the central region is applied for the medium x region (absolute $x < 0.6$). The model successfully fits the data on kaon(+) + proton yields kaon(0) + X and kaon(-) + proton yields antikaon(0) + X in absolute $x < 0.6$, explains the early scaling in absolute $x > 0.2$, and can account for the approach to the scaling limit from below at $x = 0$. Except for the region absolute $x > 0.7$, where two-body or quasi-two-body processes may play an important role, and except for the processes where leading particle effects seem important, the model successfully fits the data. Author

N73-16669# Tokyo Univ. of Education (Japan). Dept. of Physics.
HIGH ENERGY ELECTRON-PROTON INELASTIC SCATTERING AND GENERALIZED VECTOR MESON DOMINANCE MODEL IN THE RELATIVISTIC EXTENDED QUARK MODEL
Tsunehiro Kobayashi Oct. 1972 14 p refs
(TUEP-72-43) Avail: NTIS HC $3.00

A generalized vector meson dominance model which is described in terms of infinite numbers of vector mesons predicted by the quark model with a relativistically extended internal structure is applied to high energy electron-proton inelastic scattering. The Bjorken limit with large omega is considered. Author

N73-16670# Illinois Univ., Urbana. Dept. of Physics.
ELECTRON-POSITION ANNIHILATION FROM THE LIGHT CONE
A. L. Mason Dec. 1972 30 p refs
(Grant NSF GP-25303)
(ILL-(TH)-72-12) Avail: NTIS HC $3.50

Light cone expansions and the Callan-Symanzik equation are used to calculate some structure functions of nonforward virtual Compton amplitudes in renormalizable field theories. By making an analytic continuation of the discontinuity, integral equations for positron electron annihilation structure functions are obtained. These are equivalent to equations previously found by direct summation of diagrams. Author

N73-16671# Northeastern Univ., Boston, Mass.
SEARCH FOR NARROW STRUCTURE IN THE S, T, U REGION
D. Bowen, D. Earles, W. Faissler, D. Garelick, M. Gettner, M. Glaubman, B. Gottschalk, G. Lutz, J. Moromisato, E. I. Shibata et al Dec. 1972 13 p refs Prepared jointly with State Univ. of New York, Stony Brook
(Grants NSF GP-9217; NSF GP-25307; NSF GP-32952)
(NUB-2167) Avail: NTIS HC $3.00

Measurement of the missing mass spectra from the reaction negative pion plus proton yields negative missing mass plus proton at 11, 13.4 and 16 GeV is reported in the region of the S(1930), T(2200) and U(2375) mesons. The mass spectra exhibit no narrow enhancements in this region. Author

N73-16672# Northeastern Univ., Boston, Mass. Dept. of Physics.
HOW TO GENERATE THE POMERON FROM THE BACKGROUND IN A DUAL MULTIPERIPHERAL MODEL
Huan Lee Nov. 1972 12 p refs Sponsored in part by NSF
(NUB-2164) Avail: NTIS HC $3.00

A dual multiperipheral model is proposed in which important roles are played by duality, multi-Reggeism and unitarity. The leading Regge trajectory bootstraps itself through its multiple exchanges in the resonating contributions. Futhermore, its multiple exchanges in the background contributions naturally generates a constant total cross section. Comparing the prediction on mean multiplicity with existing data, the intercept of the leading Reggeon was deterimed to be alpha (0) = 0.49 + or - 0.07, in excellent agreement with observed values. The bootstrapping potential and other interesting results of the model are discussed. Author

N73-16673# Northeastern Univ., Boston, Mass. Dept. of Physics.
A NEW SUM RULE FOR PHOTOPRODUCTION AMPLITUDES AND A CHALLENGE FOR THE PARTON MODEL
Hyman Goldberg Dec. 1972 10 p refs Sponsored in part by NSF
(NUB-2169) Avail: NTIS HC $3.00

A sum rule for isovector Compton scattering, previously derived using dispersive techniques, is rederived using the ++ light cone commutator. The (non-trivial) limit of the sum rule at q squared = 0 is given, and is found to be in excellent agreement with experiment. It is then shown that a free fermion parton model is inconsistent with the sum rule in the deep inelastic limit. Author

N73-16674*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE REACTION PROTON DEUTERON YIELDS TRITON PION AT 470 AND 590 MeV
W. Dollhopf (Coll. of William and Mary), C. Lunke (Neuchatel Univ.), C. F. Perdrisat (Coll. of William and Mary), W. K. Roberts, P. Kitching (Univ. of Alberta), W. C. Olsen (Univ. of Alberta), and J. R. Priest (Miami Univ., Ohio) 1973 17 p refs Presented at 1973 Ann. Meeting of the Am. Phys. Soc., New York, 29 Jan. - 1 Feb. 1973 Sponsored in part by Research Corp.
(NASA-TM-X-68187; E-7325) Avail: NTIS HC $3.00 CSCL 20H

The preliminary results from a study of the deuteron (proton, positive pion)triton reaction are reported. The differential cross section for this reaction was measured for a number of center of mass angles from 37 deg to 160 deg at incident proton energies of 470 and 590 MeV. The cross sections measured at 590 MeV agree with predictions made considering a two-nucleon process. The 470 MeV data shows a peak in the backward direction which is not predicted by this mechanism. Author

N73-16675*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBULENT TRANSPORT MEASUREMENTS WITH A LASER DOPPLER VELOCIMETER
Robert V. Edwards (Case Western Reserve Univ.), John C. Angus (Case Western Reserve Univ.), and John W. Dunning, Jr. 1972 17 p refs Presented at 1st Pacific Chem. Eng. Meeting, Kyoto, Japan, 10-14 Oct. 1972; sponsored by Japanese Soc. of Chem. Engr. Sponsored in part by ONR, NIH, and NSF
(NASA-TM-X-68184; E-7299) Avail: NTIS HC $3.00 CSCL 20H

The power spectrum of phototube current from a laser Doppler velocimeter operating in the heterodyne mode has been computed. The spectrum is obtained in terms of the space time correlation function of the fluid. The spectral width and shape predicted by the theory are in agreement with experiment. For normal operating parameters the time average spectrum contains information only for times shorter than the Lagrangian integral time scale of the turbulence. To examine the long time behavior, one must use either extremely small scattering angles, much longer wavelength radiation or a different mode of signal analysis, e.g., FM detection. Author

N73-16676*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DISSOCIATION RATE OF BROMINE DIATOMICS IN AN ARGON HEAT BATH
Ronald Razner and David Hopkins Washington Jan. 1973 122 p refs
(NASA-TN-D-7077; E-6902) Avail: NTIS HC $3.00 CSCL 20H

The evolution of a collection of 300 K bromine diatomics embedded in a heat bath of argon atoms at 1800 K was studied by computer, and a dissociation-rate constant for the reaction Br2 + BR + Ar yields Br + Ar was determined. Previously published probability distributions for energy and angular momentum transfers in classical three-dimensional Br2-Ar collisions were used in conjunction with a newly developed Monte Carlo scheme for this purpose. Results are compared with experimental shock-tube data and the predictions of several other theoretical models. A departure from equilibrium is obtained which is significantly greater than that predicted by any of these other theories. Author

N73-16677*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETIC-FIELD MEASUREMENTS FOR THE LEWIS RESEARCH CENTER CYCLOTRON
Theodore E. Fessler Washington Feb. 1973 52 p refs
(NASA-TM-X-2692; E-6956) Avail: NTIS HC $3.00 CSCL 20C

The magnetic field of the Lewis Center cyclotron was mapped by using a Hall-effect magnetic-field transducer. Main-field Fourier coefficients were determined on a polar mesh of 40 radii for each of seven levels of main-field coil current. Incremental fields for eight sets of trim coils and two sets of harmonic coils were also determined at four of these main-field levels. A stored-program, digital computer was used to perform the measurements. The process was entirely automatic; all data-taking and data-reduction activities were specified by the computer programs. A new method for temperature compensation of a Hall element was used. This method required no temperature control of the element. Measurements of the Hall voltage and Hall-element resistance were sufficient to correct for temperature effects. Author

N73-16678# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Inst.
ELECTRA: A COMPUTER PROGRAM FOR CALCULATION OF SPACE-CHARGE-FREE PARAXIAL TRAJECTORIES IN AXIALLY SYMMETRIC ELECTROSTATIC FIELDS
H. Meier, S. Pissenberger, and F. Ruedenaver Mar. 1972 17 p In GERMAN; ENGLISH summary
(SGAE-2007; PH-115/72) Avail: AEC Depository Libraries

A description and a user's manual for the computer program

ELECTRA are presented. The program computes paraxial trajectories in axially symmetric electrostatic fields without taking into account space charge effects. Values of the electrostatic potential have to be known in discrete points along the axis of symmetry. Trajectories in an electron gun are computed as a program test. Author (NSA)

N73-16679# Atomic Energy Establishment, Cairo (Egypt). Nuclear Chemistry Dept.
ANION EXCHANGE STUDIES OF TIN(IV) COMPLEXES WITH SOME CARBOXYLIC ACIDS
S. Allam and A. A. Abdel-Rassoul 1971 31 p refs
(AREAEE-128) Avail: AEC Depository Libraries

The stability constants of the tin (IV) complexes with malonic, lactic, oxalic, succinic, malic, tartaric, and citric acids are reported. The distribution of the tin complexes by the 21-K anion exchange resin has been determined as a function of both, pH of solutions and ligand concentrations. Graphical and mathematical treatments of the data show that metal-organic complexes in the ratio 1:1 were the predominant species formed in all acid solutions. Author

N73-16680# Atomics International, Canoga Park, Calif. Centre d'Etudes Nucleaires.
NEUTRON SCATTERING FROM SUPPORTING STRUCTURES OF SNAP-8 SHIELD-REACTOR PACKAGE INFORMATION SAMPLING IN NUCLEAR SPECTROMETRY Ph.D. Thesis - Paris Univ., Orsay
H. L. Friedman 6 Sep. 1961 126 p refs In FRENCH
(Contract AT(11-1)-GEN-8)
(NAA-SR-Memo-6728) Avail: AEC Depository Libraries

The sampling of temporal information was studied by observing the signals produced at the output of planar lithium compensated germanium p-i-n detectors in gamma ray spectrometry. Fluctuations in the form of the signals were overcome by making the detection threshold as low as possible. The noise problem which subsequently arose was resolved by the use of time discrimination applied to both the signal and the noise. The time discriminator studied consists of a delay system which only transmitted temporal information when the duration of the signal above the threshold was greater than the delay of the system. Author (NSA)

N73-16681# Ohio State Univ. Research Foundation, Columbus.
A STUDY OF ION TRAJECTORIES IN POTENTIAL FLOWS Interim Technical Report
Michael R. Deluca and Henry R. Velkoff Jul. 1972 109 p refs
(Contract DA-31-124-ARO(D)-246; DA Proj. 200-10501-B-700)
(AD-751785; AROD-4942-19-E; ITR-11) Avail: NTIS CSCL 20/3

An analytical investigation of the motion of ions in a fluid was conducted to provide insight in the use of ions as a fluid flow diagnostic tool. Assuming small space charge density, potential fields and flows were considered. The specific cases studied were fine corona wire to a circular cylinder. Both steady and nonsteady flows were considered, and the trajectories of the ions leaving the corona wire were mapped. Author (GRA)

N73-16969 Politecnico di Torino (Italy). Ist. di Fisica Generale.
POSITRON ANNIHILATION IN WATER AND ICE [L'ANNICHILAZIONE DEL POSITRONIO IN ACQUA E GHIACCIO]
P. Colombino *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 253-259 refs In ITALIAN (For availability see N73-16950 07-34)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-16682 Colorado Univ., Boulder.
AN EXPERIMENTAL INVESTIGATION OF MICROWAVE REFLECTIONS FROM SHOCK-PRODUCED ELECTRON DENSITY RAMPS IN NITROGEN-OXYGEN GAS MIXTURES Ph.D. Thesis
Victor Ronald Buonadonna 1971 141 p
Avail: Univ. Microfilms Order No. 72-17245

The reflection of low power microwaves from electron density ramps in plasmas is well known theoretically. Experimental verification was undertaken to determine the applicability of the theoretical studies for the case where the microwave frequency is much smaller than the electron-neutral collision frequency. Electron density ramps were produced behind Mach 8 shock waves in nitrogen oxygen gas mixtures and 2.671 GHz microwave signal was reflected off the ramp. The magnitude of the microwave reflection coefficient was measured using a standing wave ratio technique. Excellent agreement was obtained for the nitrogen plus 2% oxygen gas mixture. The calculated reflection coefficients for 1% and 1/2% oxygen gas mixtures were systematically higher than measured reflection coefficients. Dissert. Abstr.

N73-16683 Virginia Polytechnic Inst. and State Univ., Blacksburg.
PROBE MEASUREMENTS OF ELECTRON DENSITY PROFILES DURING A BLUNT-BODY REENTRY Ph.D. Thesis
William Linwood Jones, Jr. 1971 182 p
Avail: Univ. Microfilms Order No. 72-18010

The plasma sheath which envelops a spacecraft during entry into an atmosphere disrupts radio frequency communications and gives rise to blackout. The use of fixed bias electrostatic probes inserted into the flow field as an in-flight plasma diagnostic technique is reported. It is shown that localized ambient plasma conditions can be measured by such probes and that plasma density profiles can be obtained with a rake of stationary probes mounted at different radial distances. A design is presented for an electrostatic probe system which was used during three 25,000 foot per second blunt body reentries. The theory of ion collection by a cylindrical probe in a flowing plasma is reviewed, and experimental data are given which demonstrate the applicability of this theory for interpreting probe data during flight over wide reentry altitude and velocity ranges. Dissert. Abstr.

N73-16684 Florida Univ., Gainesville.
OBSERVATIONS OF PRECURSOR IONIZATION IN ELECTROMAGNETIC T-TUBES Ph.D. Thesis
Thomas G. McRae 1971 65 p
Avail: Univ. Microfilms Order No. 72-16631

An experiment was designed which measures the photoionization of room temperature gas by radiation emitted from hot plasma. The radiation source is a Mach five shock wave in xenon which is separated from an absorption chamber by a lithium fluoride window. The shock was produced by a curved electromagnetic T-tube. The emission just prior to shock wave reflection was collimated and projected through the absorption chamber to an electrostatic double probe 232 cm away. Electron number densities were recorded in Xe, Ar, Kr, and residual gas at various absorption chamber pressures. The experiment shows that in electromagnetically driven shock tubes precursor ionization is the result primarily of radiation, not of ionizing potential waves as recently hypothesized. This ionization is produced by wavelengths greater than 1200 A but less than 3000 A. Dissert. Abstr.

N73-16685 Iowa Univ., Iowa City.
KINETIC THEORY OF A TWO-DIMENSIONAL MAGNETIZED PLASMA Ph.D. Thesis
George Martin Vahala 1972 199 p
Avail: Univ. Microfilms Order No. 72-17613

Several features of the equilibrium and non-equilibrium statistical mechanics of a two dimensional plasma in a uniform dc magnetic field are investigated. The charges interact only through electrostatic potentials. The problem is considered both with and without the guiding-center approximation. With the guiding-center approximation, an appropriate Liouville equation and BBGKY hierarchy predict no approach to thermal equilibrium for the spatially uniform case. For the non-equilibrium, non-guiding-center case a Boltzmann equation and a Fokker-Planck equation are derived in the appropriate limits. Dissert. Abstr.

N73-16686*# Stanford Univ., Calif. Inst. for Plasma Research
NONLINEAR WAVE INTERACTION IN A PLASMA COLUMN
Jean-Marc Larsen Oct. 1972 174 p refs

(Grant NGL-05-020-176; Contract N00014-67-A-0112-0044) (NASA-CR-130350; SU-IPR-493) Avail: NTIS HC $10.75 CSCL 20I

Two particular cases of nonlinear wave interaction in a plasma column were investigated. The frequencies of the waves were on the order of magnitude of the electron plasma frequency, and ion motion was neglected. The nonlinear coupling of slow waves on a plasma column was studied by means of cold plasma theory, and the case of a plasma column surrounded by an infinite dielectric in the absence of a magnetic field was also examined. Nonlinear scattering from a plasma column in an electromagnetic field having it's magnetic field parallel to the axis of the column was investigated. Some experimental results on mode conversion in the presence of loss are presented along with some observations of nonlinear scattering. The effect of the earth's magnetic field and of discharge symmetry on the radiation pattern are discussed. F.O.S.

N73-16687# Joint Publications Research Service, Arlington, Va.

MAGNETOHYDRODYNAMIC METHOD OF PRODUCING ELECTRICAL ENERGY, PART 1

V. A. Kirillin, ed. and A. Ye. Sheyndlin, ed. 9 Jan. 1973 207 p refs Transl. into ENGLISH of the book "Magnitogidrodinamicheskiy Metod Polucheniya Elektroenergii" Moscow, Energiya, 1972 360 p

(JPRS-57940-1-Pt-1) Avail: NTIS HC $12.50

A collection of articles on magnetohydrodynamic energy generation is presented. The topics discussed are: (1) the theory and calculation of flows in a MHD generator operating on an equilibrium plasma, (2) experimental investigation of open-cycle MHD generators, (3) investigations of the physical processes and diagnostics in open- and closed-cycle MHD generators, (4) investigations of the basic equipment of MHD generators, (5) investigations of circuits and cycles of power stations with MHD generators, (6) liquid-metal MHD plants, and (7) material for MHD generators. Author

N73-16688# Joint Publications Research Service, Arlington, Va.

MAGNETOHYDRODYNAMIC METHOD OF PRODUCING ELECTRICAL ENERGY, PART 2

V. A. Kirillin, ed. and A. Ye. Sheyndlin, ed. 9 Jan. 1973 209 p refs Transl. into ENGLISH of the book "Magnitogidrodinamicheskiy Metod Polucheniya Elektroenergii" Moscow, Energiya, 1972 360 p

(JPRS-57940-2-Pt-2) Avail: NTIS HC $12.50

For Abstract See N73-16687

N73-16689*# Scientific Translation Service, Santa Barbara, Calif.

DIFFUSION COEFFICIENT OF A PLASMA IN CROSSED ELECTRIC AND MAGNETIC FIELDS

I. L. Popov Washington NASA Jan. 1973 7 p ref Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. SSR (Kiev), v. 34, Mar. 1972 p 221-223

(Contract NASw-2483)

(NASA-TT-F-14523) Avail: NTIS HC $3.00 CSCL 20I

The diffusion coefficient of a fully ionized plasma is expressed. It is shown that, under certain conditions, the lifetime of a plasma in a magnetic trap can be longer, about 1 million sec. an expression for ion mobility is also derived. Author

N73-16690*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ENERGY DISTRIBUTION FUNCTIONS OF KILOVOLT IONS PARALLEL AND PERPENDICULAR TO THE MAGNETIC FIELD OF A MODIFIED PENNING DISCHARGE

Reece J. Roth Washington Feb. 1973 17 p refs

(NASA-TN-D-7167; E-7181) Avail: NTIS HC $3.00 CSCL 20I

The distribution function of ion energy parallel to the magnetic field of a modified Penning discharge has been measured with a retarding potential energy analyzer. These ions escaped through one of the throats of the magnetic mirror geometry. Simultaneous measurements of the ion energy distribution function perpendicular to the magnetic field have been made with a charge exchange neutral detector. The ion energy distribution functions are approximately Maxwellian, and the parallel and perpendicular kinetic temperatures are equal within experimental error. These results suggest that turbulent processes previously observed in this discharge Maxwellianize the velocity distribution along a radius in velocity space and cause an isotropic energy distribution. When the distributions depart from Maxwellian, they are enhanced above the Maxwellian tail. Author

N73-16691*# Humphreys Corp., Concord, N.H.

INDUCTION SIMULATION OF GAS CORE NUCLEAR ENGINE

John W. Poole and Charles E. Vogel Washington NASA Feb. 1973 44 p refs

(Contract NAS3-14416)

(NASA-CR-2155) Avail: NTIS HC $3.00 CSCL 21F

The design, construction and operation of an induction heated plasma device known as a combined principles simulator is discussed. This device incorporates the major design features of the gas core nuclear rocket engine such as solid feed, propellant seeding, propellant injection through the walls, and a transpiration cooled, choked flow nozzle. Both argon and nitrogen were used as propellant simulating material, and sodium was used for fuel simulating material. In addition, a number of experiments were conducted utilizing depleted uranium as the fuel. The test program revealed that satisfactory operation of this device can be accomplished over a range of operating conditions and provided additional data to confirm the validity of the gas core concept. Author

N73-16692# Academy of Sciences (USSR), Moscow.

RELATIVISTIC PLASMA AND THE MECHANISMS OF EMISSION

S. A. Kaplan and V. N. Tsytovich 1972 22 p refs In RUSSIAN and ENGLISH

(NP-19402; Preprint-44) Avail: AEC Depository Libraries

A model is presented for the pulsar radiation mechanism, and the properties of the associated ultrarelativistic plasma are discussed. NSA

N73-16693*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE LINEAR AND NONLINEAR IMPULSE RESPONSES FROM A MAGNETOPLASMA COLUMN

Norman Charles Grody Washington Feb. 1973 72 p refs

(NASA-TR-R-400; G-1072) Avail: NTIS HC $3.00 CSCL 20I

Linear and nonlinear responses of a magnetoplasma resulting from inhomogeneity in the background plasma density are studied. The plasma response to an impulse electric field was measured and the results are compared with the theory of an inhomogeneous cold plasma. Impulse responses were recorded for the different plasma densities, static magnetic fields, and neutral pressures and generally appeared as modulated, damped oscillations. The frequency spectra of the waveforms consisted of two separated resonance peaks. For weak excitation, the results correlate with the linear theory of a cold, inhomogeneous, cylindrical magnetoplasma. The damping mechanism is identified with that of phase mixing due to inhomogeneity in plasma density. With increasing excitation voltage, the nonlinear impulse responses display stronger damping and a small increase in the frequency of oscillation. Author

N73-16694# Los Alamos Scientific Lab., N.Mex.

SNOW-PLOW COMPUTATION IN PLASMA FOCUS

H. Rapp and M. Trunk Jun. 1971 35 p refs Transl. into ENGLISH from West Ger. report IPF-71-1 Sponsored by AEC

(LA-tr-72-24; IPF-71-1) Avail: NTIS

The acceleration process is investigated mainly as a function of the various parameter variations. The values of the current, the phase velocity, and the related energy terms at the first point of maximum current are studied. The compression process is studied as a function of time and the pinch radius. Also, the effects of the inductance of the energy reservoir are investigated. NSA

N73-16695# Joint Publications Research Service, Washington, D.C.

MEASUREMENT OF PLASMA PARAMETERS IN STRONG HF DISCHARGE

L. V. Dubovoi, B. A. Ivanov, and V. I. Chernobrovin Oct. 1972 8 p refs Transl. into ENGLISH from Russian report NP-18946 Prepared for AEC
(AEC-TR-7329; NP-18946) Avail: NTIS

An attempt is made to use a corpuscular diagnostic method for defining the local characteristics of skinned HF discharge. Plasma density and thermal skin layer thickness obtained coincide with calculated estimates and measurement data by independent methods. The results of measurements of the ion distribution function in turbulent discharges are presented.
Author (NSA)

N73-16696# Joint Publications Research Service, Washington, D.C.
CIRCUITS FOR STUDYING THE INTERACTION OF HIGH-FREQUENCY FIELDS WITH A PLASMA IN LINEAR DEVICES
I. S. Savchenko and I. R. Yampolskii Oct. 1972 18 p refs Transl. into ENGLISH from Russian report NP-18895 Prepared for AEC
(AEC-tr-7326; NP-18895) Avail: NTIS

Diagram solutions of circuits forming high frequency electromagnetic fields in experimental plasma devices with cylindrical discharge chambers are described. Circuits producing transverse rotating fields with various numbers of poles are considered. The circuits consist of eight rods located uniformly around the generatrix of a cylinder and connected in various ways with circuit condensers in an artificial retention line closed into a ring or in the form of individual magnetically connected circuits. The proposed circuits can be excited from a four phase voltage source that ensures high symmetry of the field. The circuits can be excited simultaneously at two frequencies. The properties are discussed and computational formulas for determining the basic parameters and some information on the practical achievement of the circuits are given. Author (NSA)

N73-16697# Joint Publications Research Service, Washington, D.C.
GENERAL PRINCIPLE OF CURRENT HEATING PROCESSES OF PLASMA IN PULSED z-DISCHARGES
L. V. Dubovoi Oct. 1972 7 p refs Transl. into ENGLISH from Russian report NP-18947 Sponsored by AEC
(AEC-tr-7330; NP-18947) Avail: NTIS

It is shown that in plasma heating processes in pulsed z-discharges, the gas-kinetic pressure nT of particles is related to the discharge current field for most present day experiments. Conclusions from this relation and generality of its character are discussed. Author (NSA)

N73-16698# Joint Publications Research Service, Washington, D.C.
EFFECT OF HIGH-FREQUENCY POTENTIAL ON PROPAGATION OF FAST WAVES ALONG A MAGNETOACTIVE PLASMA LAYER
V. V. Demchenko, V. V. Dolgopolov, and A. Ya. Melchenko Oct. 1972 9 p refs Transl. into ENGLISH from Russian report KHFTI-70-57 Prepared for AEC
(AEC-tr-7336; KHFTI-70-57) Avail: NTIS

The effect of electromagnetic wave field pressure on the propagation of fast waves along a plane-parallel layer of magnetoactive plasma is investigated. Expressions are derived for the fields and dispersion equations are derived in limiting cases when the high frequency potential is low or great compared with the plasma temperature. The dispersion equations differ substantially from the dispersion equations of linear theory. Plasma density distribution through layer thickness is determined. It is shown that high frequency potential may assure penetration of the electromagnetic field into plasma, which in linear approximation does not penetrate into the plasma due to the skin effect.
Author (NSA)

N73-16699# California Univ., Livermore. Lawrence Radiation Lab.
CONFINEMENT OF HOT ELECTRON PLASMA IN THE SUPERCONDUCTING LEVITRON
C. W. Hartman, O. A. Anderson, D. H. Birdsall, E. B. Hooper, Jr., and R. H. Munger 6 Jul. 1972 10 p refs Presented at the Meeting of the Am. Phys. Soc., Albuquerque, N. Mex., 5 Jun. 1972
(UCRL-73806; Conf-720608-2) Avail: NTIS

Hot electron plasma is produced by 10-GHz heating in sheared magnetic field configurations. In all configurations the onset of cold plasma during heating is accompanied by an increase in fluctuations and a decrease in n sub eh at about the Bohm rate for the cold plasma. Bursts of X-rays from the walls are correlated with fluctuations in beta suggesting anomalous loss. Puffing cold gas into hot electron plasma after heating gives slow buildup of cold plasma by ionizing collisions for several configurations. Downward jumps in beta are correlated with X-ray emission; strong microwave emission by the plasma is not observed.
Author (NSA)

N73-16700# Atomic Energy Commission, Washington, D.C.
GENERATION OF FAST ELECTRONS THROUGH INTERACTION OF SHF WAVE WITH COLLISIONLESS PLASMA
V. I. Bariyaov, I. R. Gekker, O. V. Sizukhin, and Z. G. Khachaturan Oct. 1972 7 p refs Transl. into ENGLISH from Russian report NP-18958
(AEC-tr-7331; NP-18958) Avail: NTIS

An investigation was carried out in order to determine whether or not fast electrons are generated during observation of anomalous absorption of shf waves in collisionless plasma. The plasma flow is produced by a spark injector (hydrogen - carbon plasma). Author (NSA)

N73-16701# Princeton Univ., N.J. Plasma Physics Lab.
PARAMETRIC INSTABILITY AND ITS INDUCED HEATING
T. K. Chu [1972] 15 p refs Presented at 1st Topical Conf. on RF Plasma Heating, Lubbock, Tex., 6 Jul. 1972
(Contracts AT(11-1)-3073; F30602-72-C-0053)
(Conf-720705-3) Avail: NTIS

Laboratory experiments having high-frequency excitation electric fields near omega sub pe are reviewed. Effects of the inhomogeneity of plasmas are discussed, and the potential use of parametric instability in plasma heating is assessed.
Author (NSA)

N73-16702# Los Alamos Scientific Lab., N.Mex.
SURVEY OF SCYLLAC EXPERIMENTS
S. C. Burnett, W. R. Ellis, and R. F. Gribble [1972] 12 p refs Presented at 5th European Conf. on Controlled Fusion and Plasma Phys., Grenoble, France, 21 Aug. 1972 Sponsored by AEC
(LA-DC-72-896; Conf-720804-7) Avail: NTIS

Scyllac research is currently divided among three major experimental efforts: the 5-meter 120 deg toroidal sector, a 5-meter linear theta pinch with strong end mirrors, and a feedback stabilization experiment on Scylla 4-3. In the sector the toroidal force and outward plasma drift are compensated by a combination of 1 = 1 helical fields and 1 = 0 bumpy fields. A period of equilibrium on the toroidal axis is followed by sideward motion of the plasma column, predominantly in the plane of the torus, that could either be an imbalance between the 1 = 1,0 and toroidal forces or a long-wavelength m = 1 instability. Containment times up to 11 microsec, comparable to times for plasma end loss, have been observed. Without mirrors the linear device produces a 2- to 3-keV plasma that shows a wobble of up to 1.5-cm amplitude, but otherwise remains centered. Author

N73-16703# Joint Publications Research Service, Washington, D.C.
ON THE THEORY OF TRANSFORMATION OF SURFACE WAVES INTO LONGITUDINAL OSCILLATIONS IN THE SURFACE LAYER OF A PLASMA WAVEGUIDE
V. V. Demchenko, V. V. Dolgopolov, and A. Ya. Omelchenko AEC Oct. 1972 12 p refs Transl. into ENGLISH of Akad. Nauk Ukr. SSR, Fiz.-Tekhn. Inst., Kharkov, report KHFTI-70-55 Sponsored by AEC
(AEC-tr-7335; KHFTI-70-55) Avail: NTIS

It is shown that surface waves caused by perturbation in a homogeneous plasma cylinder during the interval of time determined by the width of the narrow transition region from plasma to vacuum, are converted to longitudinal oscillations concentrated in the plasma-vacuum transition layer and propagate along the plasma density gradient. Author (NSA)

N73-16704# Joint Publications Research Service, Washington, D.C.
EXCITATION OF ELECTROMAGNETIC WAVES IN A PLASMA BY A RELATIVISTIC ELECTRON BEAM. PART 1: LONGITUDINAL WAVES
A. A. Rukhadze, L. S. Bogdankevich, and O. V. Dolzhenko AEC Oct. 1972 21 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Inst. Fiz., Moscow, report NP-18982 Sponsored by AEC (AEC-tr-7333; NP-18982) Avail: NTIS

A metal waveguide is filled with a plasma through which a relativistic electron beam passes. The hydrodynamic equations are given for a collision-free, cold plasma contained by an external longitudinal magnetic field which is greater than the beam current field. On linearizing this set of equations for small deviations from a stationary equilibrium state, a partial differential equation is obtained for the perturbed field potential. The conditions for beam instability and cyclotron instability are explored over a rather narrow range of high-frequency plasma oscillations and the conditions for long- and short-wave oscillations are also given. A discussion is presented on the production of radiation in the region of wavelengths 1 = 0.1 to 3 cm on interaction of a 1-MeV electron beam with a plasma having a particle density of 10 to the 10th power to 10 to the 12th power particles/cu cm. NSA

N73-16705# Joint Publications Research Service, Washington, D.C.
CONDITIONS FOR WAVE TRANSFORMATION IN A PLASMA WITH A NONMONOTONIC LONGITUDINAL DISTRIBUTION
V. I. Arkhipenko, V. N. Budnikov, and A. A. Obukhov Oct. 1972 15 p refs Transl. into ENGLISH from Russian report NP-18913 Prepared for AEC
(AEC-tr-7338; NP-18913) Avail: NTIS

The results of experimental studies and analysis of conditions for wave transformation in a plasma with a nonmonotonic longitudinal distribution are described. The plasma was formed in a homogeneous magnetic field at magnetic fields greater than the electron cyclotron field H greater than H sub c = mc omega/e under the action of superhigh frequency power in the 10-cm wavelength range. The experimental conditions were: the working gas was argon and the magnetic field was up to 3000 Oe. Author (NSA)

N73-16706# Joint Publications Research Service, Washington, D.C.
STUDY OF THE LOCALIZATION OF THE WAVE TRANSFORMATION REGION IN A SUPERHIGH-FREQUENCY DISCHARGE PLASMA
V. I. Arkhipenko, V. N. Budnikov, and A. A. Obukhov AEC Oct. 1972 10 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Fiz.-Tekhn. Inst., Leningrad, report NP-18912 Sponsored by AEC
(AEC-tr-7339; NP-18912) Avail: NTIS

The position of the wave transformation region in a plasma formed under the action of superhigh frequency power of the 10-cm range was investigated. Experiments were carried out in high frequency and middle regions of wave transformation in a plasma. The plasma was produced in a quartz cylinder placed in a rectangular waveguide of the 10-cm range at argon pressures of 0.1 to 0.001 mm Hg. The position of the transformation region was determined with the aid of small local perturbations of the magnetic field leading to collapse of the discharge. The longitudinal distribution of light radiation was also measured. The characteristics of the position of the transformation regions and the longitudinal distribution are discussed on the basis of the conclusions of the theory of wave transformation in a plasma with a two dimensional inhomogeneity. Author (NSA)

N73-16707# Joint Publications Research Service, Washington, D.C.
ON THE EFFECT OF WAVE FIELD PRESSURE ON LONGITUDINAL OSCILLATIONS IN A PLASMA
V. V. Dolgopolov Oct. 1972 4 p refs Transl. into ENGLISH from Russian report KHFTI-70-58 Prepared for AEC
(AEC-TR-7337; KHFTI-70-58) Avail: NTIS

The effect of HF wave potential (electromagnetic wave field pressure) on Langmuir monochromatic oscillations in plasma is investigated. It is shown that the pattern of field oscillations, constructed with consideration of the high frequency potential, differs substantially from that of oscillations in linear approximation even in the case when gas kinetic pressure of the plasma is substantially higher than the electromagnetic field pressure. In particular, localized monochromatic standing waves are found to be possible. Author (NSA)

N73-16708# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
STATIONARY TOROIDAL EQUILIBRIA AT FINITE BETA
H. P. Zehrfeld and B. J. Green Mar. 1972 27 p refs
(IPP-6/107) Avail: AEC Depository Libraries

The effects of plasma flow on axisymmetric, self-consistent equilibria in toroidal geometry are studied. On the basis of the one-fluid MHD plasma model, a concise formulation is used to elucidate important features of the equilibrium with all beta effects included. As in the treatment of the full flow problem at low beta, conditions for equilibrium are found. The form of the description allows a quite general discussion of its nature and existence for finite beta. This shows that there is a close relationship between the solvability conditions for equations arising from integrals of the system, and the nature of the characteristics of the partial differential equation describing the radial force balance. In the case of large aspect ratio, these considerations lead to a generalized Bennett relation and to an expression for plasma displacement exhibiting beta and flow effects. Author (NSA)

N73-16709# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
DEVELOPMENT AND PROPERTIES OF THE HALO IN PINCH PLASMAS
Juergen Freund Feb. 1972 94 p refs In GERMAN; ENGLISH summary
(IPP-1/125) Avail: AEC Depository Libraries

In pinch discharges a second plasma region outside the central plasma column has been observed, which is called halo. This surrounding plasma was investigated in the experiments with the 5.4-m-long compression coil in the ISAR I linear theta pinch. The development of the discharge was observed with image converters and a streak camera. The smear pictures show that after 6 to 8 microseconds the halo region is frozen into the external magnetic field, i.e., from this time the halo is characterized by a high electric conductivity. The boundary layer of the halo follows a magnetic flux tube. The parameters of the halo were determined spectroscopically as a function of time and location from the broadening of the deuterium Balmer lines. Author (NSA)

N73-16710# Sydney Univ. (Australia). School of Physics.
WILLS PLASMA PHYSICS DEPARTMENT TWENTY-THIRD SIX-MONTHLY PROGRESS REPORT, 1 JANUARY - 30 JUNE 1972
1972 8 p refs
(NP-19414; PR-23) Avail: AEC Depository Libraries

Progress in the following topics is summarized: plasma sources; hydromagnetic ionizing fronts; plasma decay; rotating plasmas; cyclotron harmonic waves; hydromagnetic waves; laser diagnostics; and far-infrared. NSA

N73-16711# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
THEORETICAL AND EXPERIMENTAL STUDIES OF ELECTRON PLASMA WAVE ECHOES Ph.D. Thesis - Paris Univ., France
Michel Guillemot Apr. 1972 220 p refs In FRENCH; ENGLISH summary
(EUR-CEA-FC-639) Avail: AEC Depository Libraries

Electron plasma wave echoes are studied theoretically using a trajectory method. In this way, the disymmetric role played by the two parent waves producing the echo and saturation effects occurring when the amplitude of the second wave increases, are established. A deformation in the echo profile with variations in the second wave amplitude is predicted from the radial density profile and finite radial geometry considerations. Velocity space diffusion due to small angle collisions produces a strong damping effect. Experimental results that are in good agreement with

theoretical predictions enable the emitted wave amplitude to be established and lead to an order-of-magnitude estimation of the turbulent fields producing the diffusion. NSA

N73-16712# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
PENETRATION OF TRAVELLING HIGH-FREQUENCY ELECTROMAGNETIC FIELD INTO A NON-TRANSPARENT PLASMA
V. V. Demchenko and A. M. Hussein 1971 20 p refs
(AREAEE-124) Avail: AEC Depository Libraries

The effect of the averaged force of a high frequency field on the propagation of electromagnetic waves by external harmonic currents is investigated in bounded plasma configurations. The account of high frequency pressure is shown to result in the following: the plasma which was non-transparent for waves in a linear approximation (with no account of high frequency pressure) becomes transparent or, in the nonlinear approximation, the waves can penetrate into the plasma if the field is skinned in the linear approximation. Author (NSA)

N73-16713# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
THEORY OF PARAMETRIC EXCITATION OF OSCILLATIONS IN AN INHOMOGENEOUS PLASMA
V. V. Demchenko and I. A. El-Naggar 1971 23 p refs
(AREAEE-125) Avail: AEC Depository Libraries

Nonlinear effects that affect longitudinal oscillations of inhomogeneous plasma in the vicinity of plasma (hybrid) resonance points are investigated. The account of nonlinear terms due to plasma inhomogeneity in the equations of motion is shown to lead to the possibility of parametric buildup of oscillations at the subharmonic (harmonic) of the applied field frequency. Author (NSA)

N73-16714# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research.
IMPERMEABLE PLASMAS CONFINED IN POLOIDAL MAGNETIC FIELDS
B. Lehnert Sep. 1972 107 p refs
(TRITA-EPP-72-21) Avail: NTIS HC $7.50

Theoretical and experimental research on plasma confinement and stability is reviewed, in connection with fusion research on laboratory scale and with the development of a full-scale fusion reactor. The review is based on the following characteristics. (1) The plasma density is chosen in the impermeable range. In this range, a hot laboratory plasma can be shielded from a surrounding gas blanket by a narrow partially ionized boundary layer. (2) Plasma confinement is provided by a purely poloidal magnetic field, generated by an internal conductor system, in order to produce a closed magnetic bottle. (3) Plasma generation and preheating by the rotating plasma technique and (4) plasma stabilization by the action of limiters are also examined. Author (ESRO)

N73-16715# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
MODELS OF FORCE-FREE MAGNETIC FIELDS IN RESISTIVE MEDIA
Rolf Bostroem Nov. 1972 50 p refs
(TRITA-EPP-72-24) Avail: NTIS HC $4.50

A review is given of the basic properties of force-free magnetic fields under circumstances when the conductivity of the medium is finite, the electric current density is related not only to the magnetic field, but also by Ohm's law to the electric field and plasma velocity, which must be considered in the solutions. It is pointed out that the natural constraint that the electric field and plasma velocity should be finite everywhere is not fulfilled in some previously used models. It is shown that solutions of constant alpha cannot be matched to an external current-free region of finite conductivity since alpha can have no discontinuity in a medium where the conductivity varies continously, thus models with alpha varying a and a moving plasma must be used. Some new, simple and consistent models are derived by prescribing the form of the magnetic field lines, one electric field component, or one time-dependent electric current component. Author (ESRO)

N73-16716# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
ON THE SCALING LAWS OF PERMEABLE AND IMPERMEABLE TOKAMAK PLASMAS
B. Lehnert 19 Nov. 1972 39 p refs
(TRITA-EPP-72-26) Avail: NTIS HC $4.00

The properties of permeable and impermeable plasmas are discussed, and the effects of plasma-neutral gas interaction on the equilibrium and stability of permeable Tokamak plasmas are considered. The results from Tokamak experiments cannot be extrapolated to full-scale fusion reactors which are likely to operate in the impermeable range. The stability and plasma density limits obtained from present theory are consistent with the experiments. Author (ESRO)

N73-16717# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron Physics.
SHOCK HEATING OF PLASMA BY MEANS OF SUPERPOSED FIELDS AND MAGNETIC ENERGY STORAGE. SOME NEW IDEAS
Einar Halmoey Dec. 1972 29 p refs
(TRITA-EPP-72-29) Avail: NTIS HC $3.50

The advantages of magnetic and electrostatic energy storage for pulsed plasma applications are evaluated. A method is discussed for superposing magnetic fields to generate both acceleration and an equilibrium force of long duration. A scheme for superposing two superconducting circuits with constant initial currents is suggested. Solutions are found for the currents, as the inner conductor is deformed in one dimension. The current solutions are combined with the momentum equation of the snow-plow model to give the speed of a plasma current sheet as a function of position. The decay of a plasma current at rest and its effect on the equilibrium force are considered. The feeding and switching of the high currents in the superconductors are discussed, and approaches to these problems are suggested. Author (ESRO)

N73-16718# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRAULICS OF MAGNETOHYDRODYNAMIC MACHINES
A. V. Tananev 1 Sep. 1972 299 p refs Transl. into ENGLISH of the book "Gidravlika Magnitogidrodinam. Mashin." Moscow, 1970 p 1-271
(AD-751465; FTD-MT-24-2001-71) Avail: NTIS CSCL 20/9

Magnetohydrodynamic machines are examined from the subject of hydraulics. Familiar studies on the motion of viscous incompressible fluid in pipes and in the boundary layer, including flows in the presence of a magnetic field, are generalized with respect to the flows in the circulatory system of magnetohydrodynamic (MHD) machines. Methods of calculating these flows are stated. New results of theoretical and experimental studies on the hydraulic properties of linear MHD machines are given. Author (GRA)

N73-16719# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF NORMAL IONIZING SHOCK WAVES IN ARGON M.S. Thesis
Raymond Joseph Hogan Jun. 1972 63 p refs
(AD-751594) Avail: NTIS CSCL 20/9

Normal ionizing shock waves in neutral argon gas were generated using a cylindrical theta pinch. Axial propagation of these shock waves has been investigated using photoelectric detectors. Magnetic and electrostatic probes were used to give additional information regarding shock structure. The investigation was carried out using steady state magnetic fields normal to the shock front, with a maximum field of 7200 gauss. Initial gas pressures ranged from 0.02 to 1.0 Torr. The investigations included studies of the effects of initial pressure, magnetic field, and capacitor bank voltage upon the shock velocity. Included is a brief discussion of the theta pinch along with the current theory of normal ionizing shock waves. Author (GRA)

N73-16720# Naval Postgraduate School, Monterey, Calif.
COMPUTER MODELING OF SPACE CHARGE FLOW IN AN ELECTROGASDYNAMIC GENERATOR M.S. Thesis
Carl Martin Bohley Jun. 1972 86 p refs
(AD-751632) Avail: NTIS CSCL 10/2

In an electrogasdynamic (EGD) generator the flow of a neutral

medium, carrying unipolar electrical charges, constitutes an electrical current. A model of the charge flow in an EGD generator was constructed for use in a computer program. The program is designed to solve Poisson's and Laplace's equations for both axisymmetric and two-dimensional geometries. Schlieren photographs of the charge cloud were used to determine the charge cloud profile required by the program. Computer generated predictions agreed with three known solutions to Poisson's equation. Computer predictions of the effects of space charge flow modifications were obtained. Space charge flow was modified both by increasing flow speed and by manipulating the space charge electric field. Experimentally, this was accomplished by increasing flow stagnation pressure and by application of a separate controllable electric field. Experimental results compare favorably with computer predictions. Some measurements were also made of the mobility range of the charged particles.
Author (GRA)

N73-16721# Naval Postgraduate School, Monterey, Calif.
STUDY OF IONIZING SHOCK WAVES GENERATED BY A THETA-PINCH IN AN ARGON GAS M.S. Thesis
Michael Glen OShea Jun. 1972 64 p refs
(AD-751659) Avail: NTIS CSCL 20/9

A study was made of shock waves produced in neutral argon gas by a theta-pinch device. From the study, graphs were made of the velocity of the shock wave observed versus the applied magnetic field, the bank voltage of the capacitor bank, and the argon pressure in the plasma chamber. Author (GRA)

N73-16722# Naval Research Lab., Washington, D.C.
MODEL EQUATIONS FOR MODE COUPLING SATURATION IN UNSTABLE PLASMAS
Edward Ott, Wallace M. Manheimer, David L. Book, and Jay P. Boris Aug. 1972 36 p refs
(AD-751538; NRL-MR-2487) Avail: NTIS CSCL 20/9

One of the simplest nonlinear effects which are capable of saturating the growth of a linearly unstable wave or spectrum of waves is resonant mode coupling. The process of resonant mode coupling is not itself a dissipation mechanism but simply carries mode energy from an unstable to a stable region of wave number space. When the rate of energy influx from the linear instability is balanced by the rate of out flow from mode coupling one has reached a steady state. In the paper the authors investigate a simple, one-dimensional model for instability saturation by mode coupling. Author (GRA)

N73-16723# Systems Science and Software, La Jolla, Calif.
A STUDY OF EQUATIONS OF STATE/OPACITY OF IONIZED GASES, VOLUME 1 Final Report, 15 Oct. 1970 - 15 Oct. 1971
Howard D. Cohen and Robert C. Vik Oct. 1972 127 p refs
(Contract DASA01-70-C-0030; DNA Proj. NWE-XAXP)
(AD-751607; DNA-2794F-1-Vol-1; Rept-3SCR-859-1-Vol-1)
Avail: NTIS CSCL 20/9

The report discusses the changes that have been made in CAPO since the previous report (AD-722 709). CAPO is a program that calculates the equation-of-state, thermodynamic functions, and opacities of plasmas. In addition reports of the following papers are included: Statistical Model of Incoherent X-ray Scattering, on the Compensation Between the Bound State and Continuum Contribution to the Partition Function, and A Continuum Approximate Treatment of Ionization Potential Lowering. Author (GRA)

N73-16724# Systems Science and Software, La Jolla, Calif.
A STUDY OF EQUATIONS OF STATE/OPACITY OF IONIZED GASES. VOLUME 2: APPENDIX D: SEGMENTATION OF CAPO. APPENDIX E: LISTING OF CAPO Final Report, 15 Oct. 1970 - 15 Oct. 1971
Howard D. Cohen and Robert C. Vik Oct. 1972 151 p refs
(Contract DASA01-70-C-0030; DNA Proj. NWE-XAXP)
(AD-751608; DNA-2794F-2-Vol-2; Rept-3SCR-859-2-Vol-2)
Avail: NTIS CSCL 20/9

The report contains a listing of the CAPO program, which calculates equations-of-state, thermodynamic functions, and opacities of plasmas. This code is written in UNIVAC 1108 FORTRAN 5 and does not contain the relativistic subroutines.
Author (GRA)

N73-16725# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORMATION OF PLASMA BY AN EXPLOSION
L. N. Busurina, V. Ya. Goldin, N. M. Kalitkin, and L. C. Tsareva 25 Aug. 1972 8 p refs Transl. into ENGLISH from the mono. "Voprosy Fiziki Nizkotemperaturnoi Plazmy" Minsk, Izd-vo Nauka i Tekhnika, 1970 p 213-215
(AD-751152; FTD-HT-23-1264-72) Avail: NTIS CSCL 20/9

A finite difference method is proposed, which makes it possible to calculate the detonation and the emergence of the shock wave from the explosive into the gas. The computed relationship of the temperature of the shock wave in the gas to its velocity coincided well with the experimental data. The calculations showed that by means of explosions it is possible to create a plasma with a temperature of up to 4 eV and a pressure of up to 3,000 atmospheres. Author (GRA)

N73-16726# Columbia Univ., New York. Plasma Physics Research Lab.
SOLID DEUTERIUM EVAPORATION IN A FUSION PLASMA Interim Report
Samuel L. Gralnick Sep. 1972 118 p refs
(Contract F44620-71-C-0010; AF Proj. 9752)
(AD-751294; AFOSR-72-2051TR; Rept-58) Avail: NTIS CSCL 20/9

The high speed ballistic injection of a solid spherical pellet of deuterium into a thermonuclear reactor plasma is studied to determine the feasibility of this technique for controlled thermonuclear reactor fueling. An evaporation wave front is driven into the solid by the ambient particle energy flux which evaporates the surface of the solid. This evaporated pellet material is an ionized plasma whose temperature is initially of the order of 10,000 K. About one half of the input power to the pellet is convected away by the expanding warm plasma cloud. This evaporated plasma cloud then helps shield the pellet surface from the incident reactor electrons. The dynamics of this pellet evaporation, the expanding plasma cloud, and its shielding effect are studied in detail. The trajectory of the pellet and the deposition of the evaporated material are analyzed for the case of high speed injection into a fusion plasma whose density profile is characteristic of a large reactor. Sufficient pellet penetration can be achieved by this means at relatively small power expenditure, but very high voltage particle acceleration is required to achieve the needed input velocity. Author (GRA)

N73-16727# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
IONIC COMPOSITION OF GAS DISCHARGES Final Report, 1 Jul. 1971 - 1 Jul. 1972
Hendrick Oskam, J. Aug. 1972 20 p refs
(Contract F19628-71-C-0188)
(AD-751327; AFCRL-72-0534) Avail: NTIS CSCL 20/9

The ionic composition of plasmas produced in helium-hydrogen, neon-hydrogen and helium-hydrogen-xenon mixtures was determined for various hydrogen and xenon concentration and for total gas pressures varying from 1 to 10 Torr. For gas pressures larger than about 2 Torr. the H3(-) ion was the dominant ion for all binary mixtures studied. In the triple mixture the XeH(-) ion was the major ion for pressures larger than about 4 Torr. The ratio of the electric field strength and the gas pressure in the positive column of a dc discharge was measured in helium-hydrogen and helium-hydrogen-xenon mixtures by means of a new method. Author (GRA)

N73-16728# Illinois Univ., Urbana. Dept. of Electrical Engineering.
FEEDBACK CONTROL OF AN UNSTABLE PLASMA Final Report, 16 Sep. 1969 - 15 Jun. 1971
J. M. Crowley and C. D. Hendricks Wright-Patterson AFB, Ohio ARL Jun. 1972 84 p refs
(Contract F33615-70-C-1091; AF Proj. 7073)
(AD-751341; ARL-72-0083) Avail: NTIS CSCL 20/9

The application of feedback to the flute modes expected to arise in a rotating, cylindrical plasma confined in a magnetic mirror device is studied. A guiding center model of the plasma is formulated and used in a normal mode feedback analysis to investigate the stability of the plasma as the characteristics of the feedback loop change. Among the characteristics studied

are the exciter geometry, the detector placement, the gain of the feedback amplifier, and the resistor and capacitor values in the compensation circuit. Based on the study, a design procedure for the control of the m = 1 flute mode is formulated and illustrated. Author

N73-16729# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE DYNAMICS OF A STRONG CURRENT DISCHARGE IN AIR
N. G. Basov, B. L. Borovich, V. S. Zuev, V. B. Rozanov, and Yu. Yu. Stoilov 19 Oct. 1972 20 p refs Transl. into ENGLISH from Vop. Fiz. Nizkotemp. Plazmy (USSR), 1970 p 262-269
(AD-751414; FTD-MT-24-1265-72) Avail: NTIS CSCL 20/9

The work presents the results of gas-dynamic, optical and energy measurement of a strong-current (a current of about 400 kA) discharge in air at atmospheric pressure. During such discharges plasma with a density of 10 to the 18th power to 10 to the 19th power particles/cc and a temperature of 2-5 eV is formed. If the energy supply in the capacitors is great, then the volume of plasma proves to be so great that the dominant role in the transfer of energy is played by radiant thermal conductivity. This is the basic distinction of such discharges from a spark discharge. GRA

N73-16730# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
SYNTHESIS OF A STABLE MAGNETOPLASMA Technical Report, 1967 - 1969
Richard C. Wingerson Oct. 1972 35 p refs
(AF Proj. 7073)
(AD-751255; ARL-72-0125) Avail: NTIS CSCL 20/9

A maximum entropy principle is used to determine the equilibrium distribution of a one component, azimuthally symmetric magnetoplasma. From this distribution, the radial dependence of number density, electric field and magnetic field is determined for an ideal stable plasma. Further insight is gained by examining the theory of collisionless single particle motion. The implications of the ideal analysis are illustrated by numerical examples for both a deuterium and an argon plasma. Some major deficiencies of the ideal analysis are then presented and the effect of one of these, collisions between species, is examined to determine the collision integral for the Boltzmann equation which further constrains the plasma parameters. Finally, the relative relaxation times for various processes are determined. Author (GRA)

N73-16731# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
LOW FREQUENCY ELECTRON TEMPERATURE FLUCTUATIONS IN FULLY IONIZED PLASMAS
Walter Friz, Gerhard L. J. Mueller, and Richard S. Palmer Oct. 1972 18 p refs
(AF Proj. 7073)
(AD-751256; ARL-72-0127) Avail: NTIS CSCL 20/9

Experimental investigations were made to substantiate the existence of periodic fluctuations of the electron temperature accompanying drift type instabilities in a Q-device. Preliminary results of measurements are reported. For all cases measured, the normalized plasma temperature fluctuations T/T sub 0 were found to be smaller than the normalized density and floating potential fluctuations n/n sub 0 and e(phi sub f)/k(T sub 0). The experimental results are compared to existing theory.
Author (GRA)

N73-16732# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYSTEMS FOR THE GENERATION OF HIGH POWER PROGRAMMED PULSES IN APPARATUS WITH ADIABATIC MAGNETIC COMPRESSION OF PLASMA
A. M. Stolov, S. M. Spevakova, B. A. Larionov, and D. E. Zavarin 1972 18 p refs Transl. into ENGLISH from Elektroteknika (USSR), no. 1, 1971 p 26-28
(AD-751250; FTD-HT-23-516-72) Avail: NTIS CSCL 20/9

The authors discuss methods for shaping high-power pulses in an inductive load. An analysis is made of the processes occurring in the systems considered, with methods presented for the selection of circuit elements. Pertinent data are cited for the pulse circuits developed. GRA

N73-16733# Science Applications, Inc., La Jolla, Calif.
STUDIES IN THE PHYSICS OF X-RAY GENERATION BY LASER HEATED PLASMAS Final Report, 1 Jun. 1971 - 31 Jul. 1972
Stephen Tamor 7 Jul. 1972 49 p refs
(Contract DASA01-71-C-0135; DNA Proj. NWE-PA-010)
(AD-751048; SAI-72-548-LJ; DNA-2950F) Avail: NTIS CSCL 20/9

A discussion of the kinetics of heating radiation of a laser-heated plasma is presented. Estimates are derived for all relevant reaction rates and time scales. It is possible, on the basis of very general considerations, to predict the main features of the X-ray spectrum, the validity of the optically thin approximation, and to obtain a minimum value of the total deposited energy below which no appreciable X-ray conversion is possible. The propagation of the laser light as it approaches the critical density plane is discussed. Since a large fraction of the energy absorption actually occurs at this surface, and it is here that the usual WKB solution fails, some special cases for which exact solution is possible are examined. The final results suggest a simple estimate for the field strength near the critical density plane which is not very sensitive to the finer details of the plasma density profile. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-16734* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLID STATE DOUBLE-POLE DOUBLE-THROW RELAY Patent
Felminio Villella and Leon C. Hamiter, inventors (to NASA) Issued 16 Jan. 1973 6 p Filed 19 Aug. 1971
(NASA-Case-MFS-21270; US-Patent-3,711,728;
US-Patent-Appl-SN-173183; US-Patent-Class-307-254;
US-Patent-Class-307-255; US-Patent-Class-307-311) Avail: US Patent Office CSCL 09A

A solid state DPDT relay circuit is reported that has two pairs of p-n-p transistors. One pair normally is conductive so as to provide a closed current path to terminals connected to the collectors of its transistors, the other pair is normally non-conductive so as to provide openings in current paths to terminals connected to the collectors of its transistors. The bases in each pair of PNP transistors are connected to one another, and the emitters of both pairs are connected to two interconnected terminals. The base pairs are connected to an NPN phototransistor of a photon-coupling pair. Switching action is realized by actuation of a light-emitting diode coupled with the phototransistor to change the conductive state of the latter, which in turn changes the conductive states of both pairs of transistors.
Official Gazette of the U.S. Patent Office

N73-16735 Princeton Univ., N.J.
THE VOLUME RELAXATION ASSOCIATED WITH THE INTERSTITIAL ION IN X-IRRADIATED KBr Ph.D. Thesis
Stephen Stewart Cunningham 1971 112 p
Avail: Univ. Microfilms Order No. 72-14141

The volume relaxation was measured during isothermal annealing at 11 and 17K; and the annealing results were equal to the growth results at 9.5 and 16K respectively. The agreement of growth and annealing measurements indicates that the alpha and I defects are created and annihilated as complementary Frenkel pairs. There is an apparent temperature dependence in the measured value of the I-center volume relaxation as the result at 16K is nearly twice as large as the 9.5K value. Some F-band optical bleaching experiments were also performed to try to isolate the contributions of the various types of radiation induced defects to the total measured relaxation. Irradiation with F-band light caused a great decrease in F- and H- band concentrations; but no measurable change in the concentration of the I-band, or the measured volume change of the sample. Bleaching caused a slight increase in the alpha-band concentration, but this change was many times less than the F-band decrease. Dissert. Abstr.

N73-16736 Washington Univ., Seattle.
HEAVY ION RADIATION STUDIES IN TERRESTRIAL AND EXTRATERRESTRIAL MATERIALS Ph.D. Thesis
Martin George Seitz 1972 132 p
Avail: Univ. Microfilms Order No. 72-17959

Bulk radiation effects in extraterrestrial materials and fission track studies in returned lunar samples are considered. X-ray observations reveal macroscopic crystal distortion in terrestrial samples of pyroxenes, feldspars, quartz, apatite, epidote and muscovite irradiated with 10.4 MeV/amu argon ions to doses of 2 x 10 to the 13th power/sq cm. The distortion occurs to a lesser degree with 10.4 MeV/amu neon and not at all with 7 MeV/amu helium irradiations to doses of 4 x 10 to the 13th power and 9 x 10 to the 15th power ions/sq cm respectively. The distortion increases with decreasing energy of the irradiation, and, at any energy, is proportional to dose. Both lunar and meteoritic materials show crystal distortion similar to that produced by heavy ion irradiations. Apatite, whitlockite and zircon are of equal importance as uranium sources in the heterogeneous rock 12013. Fossil track densities in whitlockite of four lunar rocks are found to be higher than expected from primary cosmic rays and spontaneous fission of uranium. Dissert. Abstr.

N73-16737 California Univ., Los Angeles.
RAYLEIGH WAVE REFLECTION FROM ELECTRICALLY LOADED INTERDIGITAL TRANSDUCERS Ph.D. Thesis
John Francis Cashen 1971 141 p
Avail: Univ. Microfilms Order No. 72-11877

A thin film interdigital transducer (IDT), properly located upon a piezoelectric substrate, will partially reflect Rayleigh (surface acoustic) waves passing under it. The variation of reflection coefficient with the electrical loading at the terminals is studied for different IDT configurations, on YX and XY quartz, and on YZ lithium niobate. The incident Rayleigh wave pulse used for measurements was generated by impulse excitation of a distant IDT. A square acoustic pulse of known duration is generated allowing the waveform distortion due to reflection to be evaluated by a second distant IDT. The Rayleigh wave scattering process is modelled as a one-dimensional acoustic transmission line having periodic stiffness discontinuities. The reflection at each discontinuity is the algebraic sum of scattering from the differential variations in each of several different elastic parameters. Predictions of the resonant reflection level and the location of the antiresonant reflection null are in general agreement with the measurements. Dissert. Abstr.

N73-16738*# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
SOLID STATE IMAGE SENSING ARRAYS Final Technical Report
G. Sadasiv 1 Dec. 1972 77 p refs
(Grant NGR-40-004-022)
(NASA-CR-130036) Avail: NTIS HC $6.00 CSCL 20L

The fabrication of a photodiode transistor image sensor array in silicon, and tests on individual elements of the array are described along with design for a scanning system for an image sensor array. The spectral response of p-n junctions was used as a technique for studying the optical-absorption edge in silicon. Heterojunction structures of Sb2S3- Si were fabricated and a system for measuring C-V curves on MOS structures was built. Author

N73-16739# State Univ. of New York, Binghamton. Dept. of Physics.
EFFECT OF HYDROSTATIC PRESSURE ON SUPERCONDUCTING LEAD-INDIUM ALLOYS USING ELECTRON TUNNELING
H. H. Hansen, R. L. Pompi, and T. M. Wu [1972] 48 p refs
(Grant NSF GP-6213)
Avail: NTIS HC $4.50

The effect of pressure on the effective phonon spectrum, the dimensionless electron-phonon interaction strength, and the average electron-phonon coupling function was determined in the superconducting alloys Pb95In5 and Pb88In12. Electron tunneling measurements at pressures from zero to 3600 bar provided the energy gap and tunneling density of states which served as input to McMillan's gap inversion program. Pressure production was via solid helium which provided nearly hydrostatic pressures. The energy gap decreases and the phonon frequencies increase with increasing pressure. The impurity band undergoes the smallest relative shift with increasing pressure and the transverse peak exhibits the largest relative shift. The effective phonon spectrum shifts toward higher frequencies and decreases slightly in amplitude. The net result of all these effects is for a shift of the electron-phonon interaction toward weaker coupling. Author

N73-16740# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
COMPUTATION OF SPECTRAL DATA FOR A JOSEPHSON JUNCTION CIRCUIT
E. G. Johnson, Jr. and D. G. McDonald Nov. 1972 60 p refs
(NBS-TN-627) Avail: SOD $0.60 as C13.46:627

A computer program was developed to study power flow between different frequency channels in a Josephson junction circuit. The mathematical assumptions used to get such results are discussed. They are the trapezoidal approximation from spline theory and the use of a finite range of frequencies to characterize the frequency spectrum. The program, FORTRAN listing, flow charts, and program use are outline. A discussion of possible sources of errors is also included. Author

N73-16741# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
COMPUTATION OF THRESHOLD IN THIN SEMICONDUCTOR LAYERS
J. Duchene and G. Adam 13 Sep. 1971 14 p refs In FRENCH Presented at 3d Intern. Symp. on the Appl. of Vacuum Tech. in Semiconductor Ind., Electron. Components, and Microelectron., Versailles, France, 13 Sep. 1971
(CEA-CONF-1972) Avail: AEC Depository Libraries

The commutation of threshold phenomena observed in amorphous semiconductor devices is given in a number of electronic and thermic interpretations. In addition to determining the cause and effect of switching, an analysis was made of the phenomena of commutation from a purely thermic point of view. Experimental results were compared with other published works and are in reasonable agreement. Transl. by E.H.W.

N73-16742# Los Alamos Scientific Lab., N.Mex.
VIBRATION SIMULATION OF A SPACE PROBE MODEL, SUPERCONDUCTING ENERGY STORAGE COIL
John D. Rogers [1972] 15 p refs Presented at Cryog. Eng. Conf., Boulder, Colo., 9 Aug. 1972
(Contract W-7405-eng-36)
(LA-DC-72-724; Conf-720803-5) Avail: NTIS

The superconducting inductive energy storage coil described operated in the persistent mode for all the tests without going normal. The experiment indicates, within the limitations of the model, that the superconductor and winding techniques used have a high probability of successful application in the fabrication of higher-energy-storage coils. Author

N73-16743# Los Alamos Scientific Lab., N.Mex.
CROGENIC INSTRUMENTATION AT AND ABOVE LIQUID HYDROGEN TEMPERATURE: PRESENT AND FUTURE
W. E. Keller 1972 23 p refs Presented at Cryog. Eng. Conf., Boulder, Colo., 9 Aug. 1972 Sponsored by AEC
(LA-DC-72-855; Conf-720803-6) Avail: NTIS

The instrumentation problems associated with present and possible future large scale cryogenic systems operating at or above liquid hydrogen temperatures were investigated. Cryogenic systems relevant to the energy problem, and the instrumentation problem for large scale usage of cryogens are discussed along with liquifaction and refrigeration systems, storage systems, and transportation of cryogens. F.O.S.

N73-16744# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
SWITCHING EFFECT IN SILICON OXIDES DOPED BY ION IMPLANTATION
V. LeGoascoz, J. Borel, and G. Rigaux 26 Aug. 1971 17 p refs In FRENCH Presented at 3d Intern. Symp. on the Appl. of Vacuum Tech. in Semicond. Ind., Electron. Components, and Microelectron., Versailles, France, 13 Sep. 1971
(LETI/ME-773; CEA-CONF-1948; Conf-710932-3) Avail: AEC

Depository Libraries

Preliminary results from the doping of amorphous insulators by means of ion implantation are presented. The modification of the conductivity of the layers was studied as a function of the doping (phosphorus). By means of an appropriate forming process, devices having a memory-switching phenomenon were developed. The switching thresholds are low and permit the compatibility of these devices with standard command circuits. Author (NSA)

N73-16745# Commissariat a l'Energie Atomique, Limeil-Brevannes (France). Centre d'Etudes Nucleaires.

CONTRIBUTION TO THE STUDY OF GERMANIUM SEMICONDUCTOR DETECTORS IN GAMMA RAY SPECTROSCOPY. SIMULATION OF THE ENERGY SPECTRA AND CALCULATION OF THE EFFICIENCIES BY MONTE CARLO METHODS

Daniele Adam Jun. 1972 66 p refs In FRENCH

(CEA-R-4316) Avail: AEC Depository Libraries

The efficiencies of germanium semiconductor detectors are calculated by Monte Carlo methods in the range from 100 keV to 2 MeV gamma ray source energy and for different detector forms and volumes. Compared to other works, simplification is obtained in the simulation of secondary electrons. Whole simulated pulse heights distributions give good accordance with experimental spectra. Author (NSA)

N73-16746# Carborundum Co., Niagara Falls, N.Y.

DEVELOPMENT ON PROCESS FOR PRODUCING CONTINUOUS FINE DIAMETER FILAMENTS OF SUPERCONDUCTORS Final Report, 1 Jul. 1971 - 1 Jul. 1972

James Economy, Ruey Yuan Lin, William D. Smith, and C. K. Jun Wright-Patterson AFB, Ohio AFML Sep. 1972 89 p refs

(Contract F33615-71-C-1709; AF Proj. 7371)

(AD-751545; AFML-TR-72-189) Avail: NTIS CSCL 11/5

A process to produce the continuous niobium carbonitride filament yarn from both carbon and boron nitride precursors was developed. The process involved converting chemically the precursor yarns into niobium carbonitrides with niobium pentachloride in the presence of hydrogen and nitrogen. The superconductive filament yarns produced were characterized by their superconducting and mechanical properties and their surface structures. Critical temperatures up to 19 K were observed for the superconductive filaments made by this method. The critical currents of some of the filaments were determined to be 0.4-1.0 x 10 to the 5th power amp/sq cm in zero field. Procedures to prepare filaments with high flexibility and strength were also developed. Author (GRA)

N73-16747# Naval Postgraduate School, Monterey, Calif.

THE DETERMINATION OF OPTICAL PROPERTIES AND ENERGY GAP OF Pb(1-X)Sn(X)Te THIN FILMS IN THE FUNDAMENTAL ABSORPTION EDGE REGION M.S. Thesis

Victor Martin Walz, Jr. Jun. 1972 77 p refs

(AD-751650) Avail: NTIS CSCL 20/12

The optical properties of single-crystal Pb(1-x)Te thin films in the fundamental absorption edge region were investigated. Tin compositions of 0 -or- x -or- 0.24, where x is the mole fraction of SnTe, were studied from room to liquid nitrogen temperatures. Two thin film samples with x - 0.70 and x - 0.85 were also studied in an attempt to confirm the inversion of the conduction and valence bands which had been previously predicted for this narrow-gap semiconductor. The index of refraction n and the absorption coefficient alpha were determined from transmission and reflection measurements made on films 0.8 to 5.0 microns thick, which were deposited on cleaved (100) faces of KCL rocksalt substrates. The optical energy gap was determined from the position of the absorption edge in the absorption spectrum. The index of refraction was obtained using the interference fringe method. Author (GRA)

N73-16748# Honeywell, Inc., Bloomington, Minn. Corporate Research Center.

PROPERTIES AND LIMITATIONS OF LIQUID CRYSTALS FOR AIRCRAFT DISPLAYS Final Technical Report, 1 Feb. 1971 - 30 May 1972

Ultrich Bonne and John P. Cummings Oct. 1972 185 p refs

(Contract N00014-71-C-0262; NR Proj. 215-173)

(AD-751667; HR-72-285:4-35) Avail: NTIS CSCL 07/4

The objectives of the study were to determine the feasibility of using nematic liquid crystals as media for aircraft displays from the viewpoint of their temperature range, response time, grey scale and color control. These parameters were determined experimentally for various liquid crystal systems (pure compounds as well as mixtures), at various temperatures and under various operating conditions (AC and DC drive voltage, cell thickness, reflective and transmissive modes). Mathematical modeling of the temperature range achievable through formation of multiple eutectic mixtures, of response times (delay rise, and fall times), of the voltage dependent brightness of reflective and transmissive displays, and of the properties of LC color displays via the forced alignment technique matched the experimental data and was used to define the conditions (material, cell construction, and operating parameters) under which a temperature range of -54 to 71C, a 1 microsecond response time, a 10-step grey scale (in steps of 2 in conjunction with a display brightness and a viewing angle range close to those accepted for paper-and-ink displays) and a full color display can be achieved. Author (GRA)

N73-16749# North Hills Associates, Glen Cove, N.Y.

RESEARCH PROGRAM ON THREE AXIS MATRIX ADDRESSING TECHNIQUES Final Technical Report, 1 Feb. - 31 Jul. 1972

Sol Sherr 31 Aug. 1972 76 p refs

(Contract N00014-72-C-0248; NR Proj. 215-210)

(AD-751666) Avail: NTIS CSCL 09/5

A research program is described in which the feasibility of achieving significant reductions in the number of leads and electronics required for addressing and driving matrix display panels is investigated. The technique under investigation is that in which additional addressing axes are obtained by means of a multipanel assembly. The ultimate capability of the technique is shown to be the reduction of the requirements to 40 leads for a 1024 by 1024 panel. A three layer EI/Pc unit and a two layer Liquid Crystal unit are described which demonstrate the feasibility of the technique. Logical analysis and minimization formulas for cost and leads are also included. Author (GRA)

N73-16750# California Univ., Irvine.

THEORY OF SURFACE POLARITONS IN SEMICONDUCTORS

R. F. Wallis, J. J. Brion, E. Burstein, and A. Hartstein Jun. 1972 9 p refs Prepared in cooperation with Pennsylvania Univ., Philadelphia

(Contract N00014-69-A-0200-9003)

(AD-751671; TR-72-37) Avail: NTIS CSCL 20/12

A theoretical discussion is presented of the dispersion curves for surface polaritons associated with surface plasmons and surface magnetoplasmons in semiconductors possessing depletion and accumulation layers. The results indicate how information concerning the thickness and carrier concentration can be derived from experimental data. Author (GRA)

N73-16751# Stanford Univ., Calif. Dept. of Applied Physics.

SUPERCONDUCTIVITY AND MAGNETISM OF INTERCALATED AND INTERMETALLIC COMPOUNDS Final Report, 1 Jan. 1968 - 30 Sep. 1972

T. H. Geballe 30 Sep. 1972 13 p refs

(Grant AF-AFOSR-1510-68; AF Proj. 9764)

(AD-751497; AFOSR-72-1972TR; ML-2) Avail: NTIS CSCL 20/12

The report describes briefly research on the synthesis of new superconducting compounds. The interactions giving rise to their superconductivity have been studied by magnetic, electrical and thermal techniques. The magnetic ordering in a series of rare-earth compounds has also been studied, particularly the interaction of localized 4f levels with the conduction electrons. New calorimetric and optical reflectivity measuring apparatus were developed which make use of silicon chip devices operating at low temperatures. Author (GRA)

N73-16752# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ACCRETION OF ZINC TELLURIDE ON ZINC SELENIDE USING THE REACTION DIFFUSION METHOD

N. N. Koren and N. N. Sirota 17 Oct. 1972 9 p refs Transl. into ENGLISH from Akak. Nauk BSSR Vestsi Ser. Fiz-Matemat. Navuk (USSR), no. 4, 1969 p 134-136
(AD-751476; FTD-HT-23-1481-72) Avail: NTIS CSCL 20/12

The article discusses a method for growing the semiconductive two-layer structures of ZnSe-ZnTe with varying degree of conductivity by changing the atmospheres (selenide, tellurium). These studies are of practical interest as ZnSe has n-conductivity and ZnTe has p-conductivity. Author (GRA)

N73-16753# Texas Instruments, Inc., Dallas.
LIQUID CRYSTAL DISPLAY PANEL Quarterly Technical Report, 1 Apr. - 30 Jun. 1972
A. R. Kmetz Oct. 1972 34 p refs
(Contract DAAB07-72-C-0158)
(AD-751747; TI-08-72-43; ECOM-0158-1; QTR-1) Avail: NTIS CSCL 09/5

An objective of this program is to demonstrate the feasibility of developing an effective x-y addressed liquid crystal display by fabricating a three-inch square, flat, liquid crystal display panel incorporating all addressing and drive circuitry for the display of alphanumeric and vector-graphical information at a resolution of 30 lines per inch. An experimental determination of yield statistics for double-level metallization was performed. Circuitry design is complete, and detailed MOS layout is well under way for the entire integrated circuit. A technique has been developed for joining the four slices into a mosaic. Initial experiments gave acceptable results concerning flatness and freedom from surface damage. GRA

N73-16754# CTS Knights, Inc., Sandwich, Ill.
PRECISION SSB CRYSTAL UNITS Interim Technical Report
John F. Silver and Louis A. Dick Sep. 1972 66 p
(Contract DAAB07-71-C-0198)
(AD-751748; ECOM-0198-1) Avail: NTIS CSCL 09/1

The report deals with the history, theoretical model and derived postulates of design, processing and measurement of fundamental mode 5 MHz resonators capable of reaching an aging rate of 2 x 10 to the minus 10 power per week within eight weeks and withstanding wide range temperature cycling with no more than plus or minus 1 x 10 to the minus 8 power permanent shift in frequency per temperature cycle. Experimental work has been limited to attempts to replace bonding cements with electro-plated nickel bonds and thereby obtain optimal advantage from the higher temperature processing capabilities so afforded. The results of this work are generally promising. Author (GRA)

N73-16755# Naval Research Lab., Washington, D.C.
PROSPECTUS FOR THE DEVELOPMENT OF LIQUID-CRYSTAL WAVEGUIDES Interim Report
Joel M. Schnur and Thomas G. Giallorenzi 10 Nov. 1972 20 p refs
(RR0110741)
(AD-751537; NRL-7507) Avail: NTIS CSCL 20/6

The report considers the use of liquid crystals in integrated optical circuits. Because the orientational pattern of a given liquid-crystal state is strongly influenced by electric, magnetic, and acoustic fields, liquid crystals offer attractive alternatives to the fabrication of active integrated circuits. The different configurations that may be used to form liquid-crystal microoptic devices are discussed. A comprehensive analysis of the potential of liquid-crystal waveguide systems is presented. Also discussed are current status of technology for the modulation of light in waveguides. Liquid crystals are considered as the waveguide boundary, as the waveguide itself, and for potential uses in liquid-core fibers. Evaluation and prospects for success are presented in the summary. GRA

N73-16756# Alabama Univ. Research Inst., Huntsville.
A UNIFIED THEORY OF THERMOVISCOPLASTICITY OF CRYSTALLINE SOLIDS
D. R. Bhandari and J. T. Oden Aug. 1972 42 p refs
(Contract F44620-69-C-0124; AF Proj. 9560)
(AD-751293; UARI-RR-128; AFOSR-72-2080TR) Avail: NTIS CSCL 20/11

A unified theory of thermoviscoplasticity of crystalline solids is presented. In particular the authors are able to show that a thermodynamics for viscoplastic materials can be accommodated within the framework of modern continuum mechanics of materials with memory. The basic physical concepts are derived from the consideration of dislocation behavior of crystalline solids. Relationships of the present approach to several of the existing theories of plasticity are examined. Author (GRA)

N73-16757# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
[SOLID STATE MATERIALS, ELECTRICAL ENGINEERING AND INFORMATION SYSTEMS, PLASMA PHYSICS AND BIOSCIENCES] Consolidated Semiannual Progress Report, 30 Sep. 1971 - 1 Apr. 1972
Apr. 1972 116 p refs
(Contract F44620-71-C-0067; Grant AF-AFOSR-1622-69)
(AD-751515; AFOSR-72-2109TR; SAPR-15) Avail: NTIS CSCL 20/12

Contents: Solid state--Materials and semiconductors; Quantum electronics; Magnetism; Metals, alloys and low temperature physics; Solid state devices; Defect chemistry and solid state electrochemistry; Plasmas and applied electromagnetics; Electrical engineering systems and information sciences--Control systems; Communication systems; Computer systems and automata theory; Electric power systems; Mathematical biosciences and biomedical engineering. GRA

N73-16758# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary, 1 May - 31 Jul. 1972
Melvin A. Herlin, Herbert G. Weiss, and Alan L. McWhorter 15 Aug. 1972 30 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-751308; ESD-TR-72-210) Avail: NTIS CSCL 20/12

Contents: Integrated circuit processing; Photolithographic interconnection of plastic-embedded semiconductor chips; Testing and mask design; Applications and circuit design; Communications, navigation, and identification (CNI) studies; Approach and landing systems; Airborne traffic situation display (ATSD); Solid state device research; Quantum electronics; Materials research; Physics of solids; Microelectronics. GRA

N73-16759# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
ELECTRICAL TRANSPORT PROPERTIES OF VANADIUM DIOXIDE NEAR ITS SEMICONDUCTOR-TO-METAL TRANSITION Interim Technical Report
William Henry Rosevear Oct. 1972 214 p refs
(Contract N00014-67-A-0298-0012; NR Proj. 017-308)
(AD-751524; HP-31) Avail: NTIS CSCL 20/12

The report discusses the phase diagram of the vanadium-oxygen system, important physical properties of VO2 with a theoretical explanation of the properties of VO2. Also discussed are possible methods of crystal growth, apparatus for Hall effect measurements, and results of the Hall effect measurements. X-ray and hydrostatic pressure measurements are included.
Author (GRA)

N73-16760# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
CURRENT STATUS OF SOME BASIC PROBLEMS IN AMORPHOUS SEMICONDUCTORS Interim Technical Report
William Paul Jul. 1972 36 p refs
(Contract N00014-67-A-0298-0012; NR Proj. 017-308)
(AD-751084; HP-30) Avail: NTIS CSCL 20/12

Information presently available on the structural, optical and electrical properties of amorphous semiconductors such as Ge is reviewed, and the agreement with predictions from current theories is assessed. Author (GRA)

N73-16761# Picatinny Arsenal, Dover, N.J.
SOME PHYSICS OF THE GRUNEISEN PARAMETER
Paul Harris and Louis Avrami Sep. 1972 38 p refs
(AD-751130; PA-TR-4423) Avail: NTIS CSCL 20/13

The physics of the Gruneisen parameter for solids is investigated from the view of conceptual and physical contributions. The relatively simple physics of a van der Waal's gas is applied to solid densities yielding a Gruneisen gamma approximately equal to 2. The separate electron and phonon contributions for metals are considered, and it is shown that

except for very high and very low temperatures the phonon contribution dominates. Procedures for evaluating gamma from shock-Hugoniot data for isotropic solids are treated, and the necessity for applying ultrasonic data to anisotropic crystals is considered. The role of the more exotic thermal excitations of solid state physics in determining gamma is mentioned.
Author (GRA)

N73-16762# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
STUDY OF THE DEFECT STRUCTURE OF THE SEMICONDUCTING COMPOUNDS AND OTHER RELATED MATERIALS III-V Final Report, 1 Jan. 1968 - 31 Mar. 1972
William G. Spitzer 27 Apr. 1972 54 p refs
(Contract F19628-68-C-0169; AF Proj. 5621)
(AD-751052; USCEE-421; AFCRL-72-0296) Avail: NTIS CSCL 20/12

The report summarizes the research efforts on a series of projects. In all cases the research concerns the vibrational properties of imperfect systems, and the systems include Li-diffused GaAs, Si-doped GaAs, Ge(x)Si(1-x), Ion implanted Al and P in GaAs, and Mg-doped GaAs. The results include the identification of two different Li complexes in GaAs, the determination of the Si complexes in GaAs, the lattice and local mode absorption in GeSi alloys and the ion-pairing between Mg and Li in GaAs. The information obtained is compared with results of other measurements and in some cases comprehensive models of the dominant defects are developed. Author (GRA)

N73-16763# Hebrew Univ., Jerusalem (Israel). Graduate School of Applied Science and Technology.
CRYSTALLIZATION IN MAGNETIC AND ELECTRICAL FIELDS Final Technical Report, Jan. - Dec. 1971
M. Schieber, M. Hanani, and J. Eidelberg 15 Jan. 1972 24 p refs
(Contract DAJA37-71-C-2618; DA Proj. 2O0-61102-B-11B)
(AD-751204; ARDG(E)-E-1382) Avail: NTIS CSCL 20/2

Procedures and results of Rochelle Salt, a ferroelectric crystal, growth in electric, magnetic and vibrational fields are presented and discussed. Evidence is given that experiences do not warrant continued effort. Preliminary results on the flux growth of barium ferrite are detailed in order to demonstrate that continued effort could lead to dislocation-free regions. The conclusion is made that highly perfect crystals for microwave applications could be produced. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-16764* Rocketdyne, Canoga Park, Calif.
HYDRAZINIUM NITROFORMATE PROPELLANT WITH SATURATED POLYMERIC HYDROCARBON BINDER Patent
Vernon E. Haury, inventor (to NASA) Issued 2 Jan. 1973 4 p Field 23 Sep. 1970 Supersedes N71-33856 (09 - 20, p 3338)
Sponsored by NASA
(NASA-Case-NPO-12015; US-Patent-3,708,359;
US-Patent-Appl-SN-74862; US-Patent-Class-149-19;
US-Patent-Class-149-36) Avail: US Patent Office CSCL 21I

A solid propellant composition is reported that contain hydrazinium nitroformate as an oxidizer, a saturated polymeric hydrocation binder and a polyisocyanate as curing agent to prevent deterioration of the propellant.
Official Gazette of the U.S. Patent Office

N73-16765*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE: REACTION CONTROL SYSTEM. CRYOGENIC LIQUID DISTRIBUTION SYSTEM: STUDY
James W. Akkerman Jan. 1972 36 p
(NASA-TM-X-68913; MSC-06737) Avail: NTIS HC$4.00 CSCL 21I

A cryogenic liquid distribution system suitable for the reaction control system on space shuttles is described. The system thermodynamics, operation, performance and weight analysis are discussed along with the design, maintenance and integration concepts. F.O.S.

N73-16766# California Univ., Livermore. Lawrence Livermore Lab.
SURVEY OF HYDROGEN'S POTENTIAL AS A VEHICULAR FUEL
A. L. Austin 19 Jun. 1972 35 p refs
(Contract W-7405-Eng-48)
(UCRL-51228) Avail: NTIS

The problems and potential of various hydrogen-based mobile fuel systems and the likely economic impact of a nationwide conversion to hydrogen are examined. The basic technical problem is to store enough hydrogen per vehicle in a small enough volume. The prospects of using gaseous and liquid hydrogen with air, liquid hydrogen with liquid oxygen, and hydrogen stored in metal hydrides in an internal combustion engine are analyzed. The practical feasibility is found to be marginal but with enough potential to justify an ongoing research program. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-16767 Cornell Univ., Ithaca, N.Y.
AN ANALYTICAL MODEL FOR PREDICTING THE PRESSURE AND FLOW TRANSIENTS IN A GASEOUS H2-O2 100 LBf THRUST REACTION CONTROL SYSTEM ROCKET ENGINE Ph.D. Thesis
James Joseph Markowsky 1971 168 p
Avail: Univ. Microfilms Order No. 72-8966

The one-dimensional equations of momentum and continuity were reduced by the method of characteristics from partial derivatives to a set of total derivatives which describe the state properties along the feedline. System components, e.g., valves, manifolds, and injectors are represented by pseudo-steady state relations at discrete junctions in the system. The results indicate the relative effect of manifold volume, combustion lag time, ignition lag time, feedline pressure fluctuations, propellant temperature, injector pressure drop, and feedline length on the chamber pressure transients. In particular, for values of combustion lag time tau of 0.5 milliseconds or greater, the chamber pressure is shown to exhibit self-excited oscillations which could be responsible for the experimentally observed high frequency combustion instability. The low frequency oscillations are shown to be the result of the feedline dynamics, while the high frequency oscillations are controlled by the coupling between tau and the fuel feedline dynamics. Dissert. Abstr.

N73-16768*# Boeing Co., Seattle, Wash. Aerospace Group.
HEUS-RS APPLICATIONS STUDY, VOLUME 2 Final Report
Jun. 1972 31 p refs
(Contract NAS2-6518)
(NASA-CR-130275; D2-116262-2-Vol-2) Avail: NTIS HC $3.75 CSCL 21H

The final report of a High Energy Upper Stage Restartable Solid (HEUS-RS) Applications Study is presented. The material deals with launch program cost comparisons associated with meeting NASA mission model requirements with several different launch vehicle approaches. Author

N73-16769*# Lockheed Propulsion Co., Redlands, Calif.
TECHNICAL REPORT ANALYSIS AND DESIGN: STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER, VOLUME 2, BOOK 1, SUPPLEMENT 1 Final Report, 13 Jan. - 15 Mar. 1972
2 May 1972 42 p
(Contract NAS8-28429)
(NASA-CR-124002; LPC-629-6-Vol-2-Bk-1-Suppl-1) Avail: NTIS HC $4.25 CSCL 21H

An analysis and design effort was conducted as part of the study of solid rocket motor for a space shuttle booster. The 156-inch-diameter, parallel burn solid rocket motor was selected as its baseline because it is transportable and is the most cost-effective, reliable system that has been developed and demonstrated. The basic approach was to concentrate on the selected baseline design, and to draw from the baseline sufficient data to describe the alternate approaches also studied. The following conclusions were reached with respect to technical feasibility of the use of solid rocket booster motors for the space shuttle vehicle: (1) The 156-inch, parallel-burn baseline SRM design meets NASA's study requirements while incorporating conservative safety factors. (2) The solid rocket motor booster represents a cost-effective approach. (3) Baseline costs are conservative and are based on a demonstrated design. (4) Recovery and reuse are feasible and offer substantial cost savings. (5) Abort can be accomplished successfully. (6) Ecological effects are acceptable. Author

N73-16770*# General Electric Co., Cincinnati, Ohio.
EXPERIMENTAL INVESTIGATION OF A 4 1/2-STAGE TURBINE WITH VERY HIGH STAGE LOADING FACTOR. 1: TURBINE DESIGN
D. C. Evans and J. M. Hill Washington NASA Jan. 1973 126 p refs
(Contract NAS3-15322)
(NASA-CR-2140) Avail: NTIS HC $3.00 CSCL 21E

The results of the Task 1 and 2 turbine design work are reported. Preliminary design is discussed. Blading detailed design data are summarized. Predicted performance maps are presented. Steady-state stresses and vibratory behavior are discussed, and the results of the mechanical design analysis are presented. Author

N73-16771*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF COMBUSTION CHARACTERISTICS OF ASTM A-1, PROPANE, AND NATURAL-GAS FUELS IN AN ANNULAR TURBOJET COMBUSTOR
Jerrold D. Wear and Robert E. Jones Washington Jan. 1973 23 p refs
(NASA-TN-D-7135; E-7078) Avail: NTIS HC $3.00 CSCL 21D

The performance of an annular turbojet combustor using natural-gas fuel is compared with that obtained using ASTM A-1 and propane fuels. Propane gas was used to simulate operation with vaporized kerosene fuels. The results obtained at severe operating conditions and altitude relight conditions show that natural gas is inferior to both ASTM A-1 and propane fuels. Combustion efficiencies were significantly lower and combustor pressures for relight were higher with natural-gas fuel than with the other fuels. The inferior performance of natural gas is shown to be caused by the chemical stability of the methane molecule. Author

N73-16772# National Aviation Facilities Experimental Center, Atlantic City, N.J.
THE FEASIBILITY OF BURNER-CAN BURN-THROUGH THERMAL DETECTION PRIOR TO ENGINE CASE RUPTURE Final Report, Jan. - Sep. 1972
Richard Hill Jan. 1973 36 p ref
(FAA Proj. 181-522-01X)
(FAA-NA-72-92; FAA-RD-72-134) Avail: NTIS HC $4.00

Full-scale tests simulating engine combustion section thermal failures (burn-through) were conducted using a J57 engine (cowled and uncowled) to determine the feasibility of detecting a burn-through prior to its occurrence by monitoring engine skin temperature. Results of the tests indicated that as few as four thermocouples, located 90 degrees apart around the diffuser case and/or burner can case, could detect a burn-through prior to engine case rupture. Author

N73-16773*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL PERFORMANCE OF CASCADE THRUST REVERSERS AT FORWARD VELOCITY
Donald A. Dietrich and Roger W. Luidens Washington 1973 22 p refs
(NASA-TM-X-2665; E-7125) Avail: NTIS HC $3.00 CSCL 21E

A series of static and wind tunnel tests were performed on four cowl cascade thrust reverser configurations which had various reversed jet emission patterns applicable to an externally blown flap STOL aircraft. The work was performed using a model fan which was 14.0 cm in diameter and passed a fan mass flow of 2.49 kg/sec at an approximate fan pressure ratio of 1.22 and fan corrected rotational speed of 35,800 rpm. The tests demonstrated that the reingestion of fan flow significantly reduced the reverser efficiency and that the thrust reverser efficiency was improved by reducing the reversed jet azimuthal emmission angle. The reverser efficiency at STOL landing speeds was as high as 0.95; however, configurations with lateral emission were adversely affected by yawing the nacelle at forward velocity. Measurements of the internal static pressure at the stator exit showed significant increases in the local static pressure for configurations with reduced jet emission angles. Author

N73-16774*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF A 2.5 CENTIMETER DIAMETER KAUFMAN MICROTHRUSTER
Allan J. Cohen Washington Feb. 1973 23 p refs
(NASA-TM-X-2708; E-7127) Avail: NTIS HC $3.00 CSCL 21H

A 2.5-centimeter-diameter Kaufman electron bombardment microthruster was fabricated and tested. The microthruster design was based on the 15-centimeter-diameter SERT 2 and 5-centimeter-diameter Lewis experimental thruster designs. The microthruster with a two-grid system, operating at a net accelerating potential of 600 volts and an accelerator potential of 500 volts, produced a calculated 445 micronewton thrust when it was run with a 9-milliampere beam current. A glass grid was initially used in testing. Later a two-grid system was successfully incorporated. Both the propellant utilization efficiency and the total power efficiency were lower than for large-size advanced thrusters, as expected; but they were sufficiently high that 2.5-centimeter thrusters show promise for future space applications. Total power of the microthruster with an assumed 7-watt hollow-cathode neutralizer was less than 30 watts at a thrust level of 445 micronewton (100 Nu LBf). The hollow cathode was operated at zero tip heater power for power requirement tests. Author

N73-16775*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF MAGNESIUM-ALUMINUM EUTECTIC TO IMPROVE COMBUSTION EFFICIENCY IN LOW BURNING RATE PROPELLANTS
Burton G. Northam and Edward M. Sullivan Washington Feb. 1973 13 p ref
(NASA-TN-D-7133; L-8546) Avail: NTIS HC $3.00 CSCL 21I

A previous investigation indicated that combustion efficiency of low burning-rate propellants could be improved if the aluminum fuel was replaced by aluminum particles coated with a magnesium-aluminum eutectic alloy (ALCAL). The purpose of the present investigation was to evaluate the possibility of improving the combustion efficiency of these propellants by admixing the eutectic with the aluminum rather than coating the aluminum. Tests of three propellants similar in every respect except for the metal fuel were conducted in test motors with 4.54 kg (10 lbm) of propellant. The first propellant used aluminum fuel; the second contained aluminum admixed with magnesium-aluminum eutectic; the third used ALCAL. The test results show the the admixed fuel gave better low burning-rate combustion efficiency than the other two. The test results also showed that the ALCAL was deficient in that much, if not all, of the coating material could be found as the fine particles in a bimodal mix of aluminum and eutectic. The combustion efficiency of low burning-rate aluminized propellants can be significantly improved by mixing a small amount of magnesium-aluminum alloy with the aluminum fuel. Author

N73-16776*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF A REDUCTION IN BLADE THICKNESS ON

PERFORMANCE OF A SINGLE STAGE 20.32 CENTIMETER MEAN DIAMETER TURBINE
William J. Nusbaum and Milton G. Kofskey Washington Feb. 1973 26 p refs
(NASA-TN-D-7128; E-7029) Avail: NTIS HC $3.00 CSCL 21E

As part of a program to reduce the manufacturing costs of a small gas-turbine engine, the turbine blading was reduced in thickness to facilitate coining. Tests were made to determine the effect of this modification on turbine performance. The working fluid was air at nominal inlet total conditions of 535 deg F and 20.0 psia. Performance results are presented and compared for four stator-rotor combinations in terms of equivalent torque, mass flow, and efficiency at equivalent design speed and at inlet-total to exit-static pressure ratios of 1.8 to 3.8 Author

N73-16777*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 5000-HOUR TEST OF A GRID-TRANSLATION BEAM-DEFLECTION SYSTEM FOR A 5-cm DIAMETER KAUFMAN THRUSTER
Walter C. Lathem 15 Jan. 1973 18 p refs
(NASA-TM-X-68185; E-7301) Avail: NTIS HC $3.00 CSCL 21C

A grid-translation type beam deflection system was tested on a 5-cm diameter mercury ion thruster for 5000 hours at a thrust level of about 0.36 mlb. During the first 2000 hours the beam was vectored 10 degrees in one direction. No erosion damage attributable to beam deflection was detected. Results indicate a possible lifetime of 15,000 to 20,000 hours. An optimized neutralizer position was used which eliminated the sputter erosion groove observed on the SERT 2 thrusters.
Author

N73-16778*# General Electric Co., Cincinnati, Ohio.
HIGHLY LOADED MULTI-STAGE FAN DRIVE TURBINE-CASCADE TEST PROGRAM
D. G. Cherry, T. K. Staley, and M. W. Thomas Washington NASA Jan. 1973 153 p refs
(Contract NAS3-14304)
(NASA-CR-2171; Rept-72AEG268) Avail: NTIS HC $3.00 CSCL 21E

Test results are presented for 19 cascades involving five plain and two tandem blade sections. High camber and/or negative reaction is associated with six of the sections. Exit Mach numbers range up to slightly above sonic. Cascade efficiency, exit flow angle and static pressure, and blade surface pressure data are reported with incidence angle, Mach number, solidity, and relative position of the tandem blades as independent variables. Author

N73-16779# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Radketenantriebe.
PERFORMANCE OF COAXIAL INJECTORS IN LIQUID OXYGEN-GASEOUS HYDROGEN [LEISTUNGSVERHALTEN KOAXIALER EINSPRITZSYSTEME IN LO2/GH2-RAKETENTRIEBWERKEN]
Hans Joachim Sternfeld Jun. 1971 106 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-56) Avail: NTIS HC $7.50; DFVLR, Porz, West Ger. 30,80 DM

Results of an experimental program for investigating combustion performance of variable thrust liquid oxygen/gaseous hydrogen rocket engines with coaxial injectors are presented. Hydrogen was injected into the combustion chamber at a mean temperature of 150 K to simulate injection condition of regeneratively cooled LO2/LH2-rocket engines. The performance parameters investigated were mixture ratio, combustion pressure, characteristic chamber length, number of concentric tube injection elements, injection area ratio, injection velocities and injection velocity ratio. The variations of mixture ratio and combustion pressure cover a range from 1 to 14 and from 4 bar to 15 bar respectively. An approximate method was used to represent the experimental results as power functions in two variables. Amplitude and frequency of combustion pressure oscillations are presented as functions of performance parameters.
Author (ESRO)

N73-16780# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
INVESTIGATION OF VARIOUS GRAIN CONFIGURATIONS CONCERNING POLYETHYLENE/FLOX-70 HYBRID ENGINE. PART 2: EXPERIMENTAL PERFORMANCE [UNTERSUCHUNG VERSCHIEDENER BRENNRAUMGEOMETRIEN FUER EIN POLYAETHYLEN/FLOX-70-TRIEBWERK. TEIL 2: LEISTUNGSVERHALTEN]
Helmut Weiler and Rolf Buchheim May 1972 46 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-61) Avail: NTIS HC $4.50; DFVLR Porz-Wahn: 15,90 DM

The performance of a hybrid FLOX-70/Polyethylene rocket engine of 400 N thrust and a multiport fuel grain geometry (cartwheel) was investigated experimentally. A combustion efficiency of 97% and an impulse efficiency of 94% were achieved. The variation of various operating parameters such as thrust, chamber pressure, mixing ratio, and burnout with time was investigated in firings of up to 35 seconds. Author (ESRO)

N73-16781# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Ramjet Applications Branch.
SUBSONIC PERFORMANCE POTENTIAL OF RAMJETS AND EJECTOR RAMJETS Technical Report, Dec. 1970 - Sep. 1971
William E. Supp, John H. Miller, and Kenneth A. Watson May 1972 99 p refs
(AF Proj. 3012)
(AD-751317; AFAPL-TR-72-7) Avail: NTIS CSCL 21/5

A method for analyzing the performance of a ramjet engine at subonsic flight speeds is presented. The absence of a known choked point (M=1) in the engine necessitates an iterative solution. A modified ideal gas analysis is utilized. Considered are the conventional ramjet with liquid fuel injection and an ejector ramjet using vaporized fuel injected into the engine at supersonic velocities. In the latter case, the fuel's momentum is significant and the ejector action draws additional air mass into the engine, which must be considered in the analysis. The method presented compares the two engine cycles at several subsonic flight speeds for both JP-4 and propane fuel. The effects of several levels of component efficiencies are considered.
Author (GRA)

N73-16782# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF HEAT TRANSFER IN GAS TURBINES (COLLECTION OF ARTICLES)
30 Aug. 1972 159 p refs Transl. into ENGLISH from Vopr. Teloperedachi V Gazovykh Turbinakh (USSR), no. 72, 1971 p 1-136
(AD-751513; FTD-HT-23-1344-72) Avail: NTIS CSCL 21/5

The articles in this collection contain the results of theoretical and experimental studies of heat transfer in gas turbines, and the temperature states of turbine blades, disks, and rotors. Analysis is given of the boundary conditions formulated when stating problems of thermal conductivity relative to gas turbines. Results are given of a generalization of criterial formulas for calculating the heat-transfer coefficient in vane cascades. Certain specific problems of thermal conductivity are solved in general form and numerically for cooled hollow blades and disks.
Author (GRA)

N73-16783*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN PRINCIPLES OF AIRCRAFT ENGINES, CHAPTERS 1-5
E. L. Feldman, G. I. Danileiko, and L. N. Kapustin 6 Jul. 1972 192 p Transl. into ENGLISH of the publ. "Osnovy Konstruktsii Aviatsionnykh Dvigateley" Moscow, Izd-vo Transport, 1970 p 1-123
(AD-751510; FTD-MT-24-1903-71) Avail: NTIS CSCL 21/5

In the book, general questions of design of gas-turbine engines (with mention of piston engines) are presented, their design diagrams are analyzed, the purpose, arrangement, and service conditions of units, assemblies and systems are described, as well as the loads experienced by them and also the materials used, the requirements imposed on structural elements and

systems, and the simplest structural designs are set forth. The book is intended as a text for students in technical schools and schools of civil aviation. It can be used by technical-engineering and flight crews of civil aviation. Author (GRA)

N73-16784# Rohr Corp., Chula Vista, Calif.
ANALYTICAL STUDY OF INFLIGHT THRUST REVERSERS, VOLUME 1 Final Technical Report, 25 Jan. 1971 - 25 May 1972
Tirumalesa Duvvuri, Hai-Yain Chang, and Barry W. Prior Jul. 1972 353 p refs
(Contract F33615-71-C-1208; AF Proj. 1476)
(AD-751525; RHR-72-365-1; AFFDL-TR-72-85-Vol-1) Avail: NTIS CSCL 21/5

Mathematical models are developed for predicting the flow fields within and external to a thrust reverser when it is deployed in flight, and the forces and moments induced on the aircraft by virtue of these flow fields. The method used are largely two-dimensional in nature, but contain empirical corrections to account for three-dimensionality. Although no testing was accomplished under this contract, the analytical predictions are compared with existing test data. A method of evaluating stowed reverser losses is given, twin-jet and unsteady flow effects are discussed and a test/analytical program is outlined which is aimed at further improving and verifying the results of the study. This volume contains the technical discussion and results of the analytical effort. Author (GRA)

N73-16785# Rohr Corp., Chula Vista, Calif.
ANALYTICAL STUDY OF INFLIGHT THRUST REVERSERS, VOLUME 2: USER'S MANUAL AND SOURCE LISTINGS FOR COMPUTER PROGRAMS
Tirumalesa Duvvuri, Hai-Yain Chang, Barry W. Prior, and Miriam J. Alcala Jul. 1972 235 p refs
(Contract F33615-71-C-1208; AF Proj. 1476)
(AD-751526; RHR-72-365-2; AFFDL-TR-72-85-Vol-2) Avail: NTIS CSCL 21/5

Fifteen computer programs have been developed to solve problems for the analytical study of inflight thrust reversers. User instructions for all 15 programs are presented in this Volume, including a brief theoretical background, the function, input and output of each program. Lists of sample input and output are also included. Listings of all computer programs are included in the Appendix. The detailed descriptions of all theoretical developments are given in Volume I of the report. Author (GRA)

N73-16786# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
TURBULENT MODELS FOR STRONGLY HEATED, DEVELOPING GAS FLOWS Final Report
Donald M. McEligot Aug. 1972 189 p refs
(Contract DAAK02-69-C-0282)
(AD-751757) Avail: NTIS CSCL 21/5

As bases for studies in the design of compressors and turbines and for turbulent flow in magnetohydrodynamic channels, basic numerical and experimental investigations were made towards developing an operational three-dimensional treatment of turbulent transport processes, with consideration of fluid property variation and body forces. Two-dimensional numerical programs were developed and applied for gaseous, internal, turbulent, boundary layer flow in circular tubes and wide rectangular ducts. Measurements under strong heating were: (a) heat transfer and friction parameters for flow through square ducts, (b) wall temperatures for mixed convection in the laminarization region in circular tubes, (c) velocity and temperature profiles in a wide rectangular duct, and (d) velocity and temperature profiles in laminarizing flow in a circular tube. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-16787 Maryland Univ., College Park.
MICROWAVE RADIATION OF WATER VAPOR IN GALACTIC SOURCES Ph.D. Thesis
Woodruff Turner Sullivan, III 1971 125 p
Avail: Univ. Microfilms Order No. 72-12857

The 1.35-cm(6 sub 16) to (5 sub 23) H2O emission in the galactic sources W3, W3-OH, Ori A, VY CMa, NGC 6334N, Sgr B2, W49, W51, ON 1, and W75S were observed in nine distinct periods extending from 1969 January to 1970 June. Both the 85-foot antenna of the Naval Research Laboratory at Maryland Point, Md., and the 140-foot antenna of the National Radio Astronomy Observatory at Green Bank, W. Va., were used. The H2O emission is in general very intense, sometimes as in W49 reaching almost 10 to the minus 21 power W/sq m/Hz. Remarkable changes have occurred in the complex frequency structure of the H2O profiles and in the intensity, width, apparent radial velocity, and linear polarization of the individual features. In many cases, as for Sgr B2 and W75S, very intense features entirely disappeared. Typical time scales for these changes range from several months to only a few days. Dissert. Abstr.

N73-16788 Cornell Univ., Ithaca, N.Y.
FLUX DENSITIES AND SPECTRA OF EXTRAGALACTIC RADIO SOURCES Ph.D. Thesis
Arthur Edwin Niell 1971 312 p
Avail: Univ. Microfilms Order No. 72-13171

Relative flux density measurements were made at 430.606 318, and 111.5 MHz using the Arecibo Observatory 1000 foot spherical antenna. The errors due to confusion and receiver noise fluctuations at 318, 430, and 605 UHz are 0.17, 0.15, and 0.07 fu respectively with percentage errors of 4, 5 and 7%. At 111.5, 318, and 606 MHz sources suspected or known to have a peculiar spectrum below 1400 MHz were observed. At 430 MHz all sources from the Parkes Catalogue in the declination range 0 to +20 deg were observed, reducing the uncertainty in the flux densities near 400 MHz from 30% for the Parkes measurements to about 7% for the Arecibo measurements for the weaker sources. The spectra below 1400 MHz of the galaxies, quasars, and blank fields in the complete sample are significantly different. Flux density measurements were also made for several hundred 4C sources at 750 and 1400 MHz.
Dissert Abstr.

N73-16789 Princeton Univ., N.J.
A MEASUREMENT OF THE ISOTROPY OF THE MICROWAVE BACKGROUND TEMPERATURE AT 6 cm WAVELENGTH Ph.D. Thesis
Karl C. Davis 1971 145 p
Avail: Univ. Microfilms Order No. 72-13737

The apparent sky brightness temperature difference between regions centered on the celestial pole and on points southward to -9.5 declination. Was measured 24 hours a day for approximately one year. Galactic radio emission at 6 cm was estimated using a 75 cm sky survey and a temperature spectral index of -2.8. An anisotropy with 24 hour spatial period with amplitude in the equatorial plane of 2.5 plus or minus 1.5 milliKelvin with direction 10 plus or minus 2 hours right ascension was observed. An anisotropy with 12 hour spatial period was found to depend strongly on a small fraction of the data near the galactic center and is believed not to be a feature of the cosmic background. Upper limits on the maximum departure from isotropy of 37 milliKelvin for 15 areas and 16 milliKelvin for 30 areas are given with 90 percent confidence for the area of the sky covered. Dissert. Abstr.

N73-16790 California Univ., Riverside.
IDENTIFICATION OF SOLAR NEUTRON EVENTS BY OBSERVATION OF RADIATION BELT PROTON FLUXES Ph.D. Thesis
Edward Scott Claflin, III 1971 186 p
Avail: Univ. Microfilms Order No. 72-17053

A region of theoretically stable trapping but experimentally low flux exists at the outer edge of the trapped proton belt. A burst of neutrons arriving at the earth following a solar flare will cause an increase in the trapped proton flux above 20 MeV. For a sufficiently intense neutron burst, an increase will be detectable in the low flux at the outer edge of the proton belt.

Lower limits on the required neutron flux are estimated and compared with upper limits established by experiment. It is found that observation of trapped neutron decay protons is potentially a factor of 10 more sensitive for detecting solar neutrons than past satellite neutron experiments. A possible example of detection of trapped neutron decay protons occurred following the 28 August 1966 solar flare. An unusual count-rate increase was observed immediately after the flare by the Explorer 26 detector. Comparison with Vela neutron detector data shows that the increase could not have been caused by trapped neutron decay protons.
Dissert. Abstr.

N73-16791 California Univ., Riverside.
A LABORATORY MODEL OF SOLAR FLARES Ph.D. Thesis
Peter Joseph Baum 1971 135 p
Avail: Univ. Microfilms Order No. 72-10391

The results of a number of experiments in the double inverse pinch device are reported. The experiments are carried out in argon, hydrogen and deuterium gases. A sequence of Kerr cell photographs taken in argon is presented. Soft X-rays occur simultaneously with the onset of anomlous resistivity in argon, coincident with the time of fast merging, magnetic field line reconnection. Timing is established to show that the X-ray burst follows the x-point current cutoff. The X-rays are caused by a small of higher energy electrons which may be accelerated by fluctuating electric fields. The X-rays originate near the x-point at the bottom plate. Large voltage fluctuations are observed also at this time of instability as measured by a floating double electrostatic probe. An upper limit is placed on the neutron flux from d-d reactions under one set of conditions. The relevance of the experiments to solar flares is discussed. Dissert. Abstr.

N73-16792 Case Western Reserve Univ., Cleveland, Ohio.
ASYMMETRIES IN THE STRUCTURE OF THE FORWARD STAGNATION REGION OF THE SOLAR WIND MAGNETOSPHERIC INTERACTION Ph.D. Thesis
Richard Stephen Hirsh 1971 219 p
Avail: Univ. Microfilms Order No. 72-6304

A new model of the solar wind geomagnetic field interaction is proposed. Three distinct regions are encountered: the shock wave, the shock layer, and a diffusive sheath. The inherent asymmetry caused by the interplanetary magnetic field, a description of the flow in the stagnation region of the magnetospheric shock layer, and an examination of the diffusive magnetopause sheath are discussed and calculated. The shock wave is regarded as very thin compared to the thickness of the shock layer or magnetosheath and so its consideration takes the form of obtaining solutions to the complete MHD oblique shock jump conditions. The leading terms are the gas dynamic results while the terms involving the upstream magnetic field represent the effects of MHD coupling on the flow and field. A comparison of gas dynamic and the MHD results shows that there is a flow deflection through the normal part of the shock. Hence the asymmetry seems to be concentrated in the stagnation region.
Dissert. Abstr.

N73-16793*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
EXPERIMENTAL STUDY OF SPECTRAL AND SPATIAL DISTRIBUTION OF SOLAR X-RAYS Final Report
Loren W. Acton, Richard C. Catura, and J. Leonard Culhane 29 Sep. 1972 74 p refs
(Contract NASw-1834)
(NASA-CR-130359; LMSC-D309802) Avail: NTIS HC $5.75 CSCL 03B

The study of the physical conditions within the solar corona and the development of instrumentation and technical expertise necessary for advanced studies of solar X-ray emission are reported. Details are given on the Aerobee-borne-X-ray spectrometer/monochromator and also on the observing program. Preliminary discussions of some results are presented and include studies of helium-like line emission, mapping O(VII) and Ne(IX) lines, survey of O(VII) and Ne(IX) lines, study of plage regions and small flares, and analysis of line emission from individual active regions. It is concluded that the use of large-area collimated Bragg spectrometers to scan narrow wavelength intervals and the capability of the SPARCS pointing control to execute a complex observing program are established. N.E.N.

N73-16794*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE OBSERVATIONS OF THE VARIABILITY OF SOLAR IRRADIANCE IN THE NEAR AND FAR ULTRAVIOLET
Donald F. Heath Dec. 1972 45 p refs Submitted for publication
(NASA-TM-X-66143; X-651-72-458) Avail: NTIS HC $4.25 CSCL 03B

Satellite observations of the ultraviolet solar irradiance in selected wavelength bands between 1200 and 3000 a were made continuously by photometers consisting of broad-band sensors operated on Numbus 3 and 4 which were launched in April 1969 and 1970. In addition, spectrophotometer measurements of the solar irradiance were made with a dispersive instrument at 12 selected wavelengths from 2550 to 3400 a with a 10 a bandpass on Nimbus 4. Variations of the solar irradiance associated with the solar rotational period were observed since the launch of Nimbus 3. These variations are apparently associated with two source regions separated by about 180 deg in solar longitude. The change in irradiance with solar rotation was found to increase with decreasing wavelengths. Different types of the observed variations in uv solar irradiance can be classified in accordance with characteristics times, e.g. in the order of increasing periods as follows: (1)flare associated enhancements (2) 27-day variations due to solar rotation; (3) a possible biennial effect; and (4) long term variations associated with the 11-year solar cycle. Author

N73-16795*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Space Sciences Dept.
MDAC SOLAR COSMIC RAY EXPERIMENT ON OGO-6 Final Report, Mar. 1966 - Jan. 1973
A. J. Masley Jan. 1973 47 p refs
(Contract NAS5-9324)
(NASA-CR-130155; MDC-G4351) Avail: NTIS HC $4.50 CSCL 03B

The instrumentation of the OGO-F solar cosmic ray experiment is described and results of data obtained during the satellite lifetime from launch on June 5, 1969, through September, 1970, are discussed. Author

N73-16796*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE NATURE OF WEAK HIGH LATITUDE X-RAY SOURCES
S. S. Holt, E. A. Boldt, P. J. Serlemitsos, and R. D. Bleach (Maryland Univ., College Park) Jan. 1973 11 p refs
(NASA-TM-X-66168; X-661-73-24) Avail: NTIS HC $3.00 CSCL 03B

The unidentified high latitude UHURU sources are shown to be consistent with an interpretation which does not require most of them to be extragalactic. Author

N73-16797*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NUCLEAR GAMMA RAYS FROM SOLAR FLARES
R. Ramaty and R. E. Lingenfelter, (Calif. Univ., Los Angeles) Jan. 1973 29 p refs
(NASA-TM-X-66165; X-660-73-14) Avail: NTIS HC $3.50 CSCL 03B

The theory of gamma ray line emission from solar flares is reviewed and revised. It is shown that the recently observed (Chupp et al., 1972) line emissions at 0.5, 2.2, 4.4 and 6.1 MeV are due to positron annihilation, deuterium deexcitation following neutron capture on hydrogen, and the deexcitation of excited states in carbon and oxygen. From the observed relative line intensities it is possible to determine the spectrum of accelerated protons in the flare region. This spectrum is found to be very similar to that the charged particles from the flare observed near earth. The total numbers of protons at the sun is deduced from the observed absolute line intensities for various interaction models. It is found that if the protons at the sun have a spectrum which is an exponential in rigidity, the total energy in protons is a few times 10 to the 28th power ergs if the gamma rays are produced by protons moving down into the sun; and about 10 to the 30th power ergs if the gamma rays are produced at the site of the acceleration. Author

N73-16798*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEUTRAL-PION-DECAY GAMMA RAYS FROM THE GALAXY AND THE INTERSTELLAR GAS CONTENT
F. W. Stecker Feb. 1973 9 p refs Submitted for publication
(NASA-TM-X-66167; X-641-73-40) Avail: NTIS HC $3.00 CSCL 03B

Knowledge of the total gamma ray production rate per H atom from the decay of pion(0) produced in interstellar cosmic ray interactions is essential for determining the possible amount of interstellar H2. This production rate is recalculated using the latest accelerator data on pion(0) production in pp interactions up to approximately 300 GeV. A simple but accurate approximation resolves the past disagreement over the magnitude of this rate. An upper limit is obtained of (1.51 + or - 0.23) x 10 to the minus 25th power/sec. consistent with the observed upper limit of 1.6 x 10 to the minus 25th power/sec. Author

N73-16799# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
ALFVEN WAVES IN THE SOLAR WIND: WAVE PRESSURE POYNTING FLUX, AND ANGULAR MOMENTUM
Joseph V. Hollweg Jul. 1972 39 p refs
(MPI-PAE/Extraterr-70) Avail: NTIS HC $4.00

Effects of Alfven waves propagating in the solar wind on angular momentum, wave pressure and Poynting flux are considered. The Alfven waves are found to reduce the azimuthal velocity at I a.u. This effect occurs because the waves are transverse and represent an additional component of the pressure perpendicular to the magnetic field. The magnitude of the effect cannot be explained by the thermal anisotropy. The angular momentum balance is also disturbed by finite wavelength effects (non-WKB). The Alfven waves reduce the azimuthal velocity of I a.u. by reducing the heliocentric distance of the critical point in the equation for this velocity. The finite wavelength effects also reduce the wave pressure close to the sun.
Author (ESRO)

N73-16800# Aerospace Corp., El Segundo, Calif. Lab. Operations.
POLAR CAP MEASUREMENTS OF SOLAR-FLARE PROTONS WITH ENERGIES DOWN TO 12.4 keV Technical Report, Oct. 1971 - Apr. 1972
Paul F. Mizera, Joseph F. Fennell, and J. Bernard Blake 1 Oct. 1972 24 p refs
(Contract F04701-72-C-0073)
(AD-751467; TR-0073(3260-20)-5; SAMSO-TR-72-254) Avail: NTIS CSCL 04/1

Solar protons with energies down to 12.4 keV were measured over the polar caps by instruments aboard the OV1-17 satellite. The observations were made following the 21 March 1969 solar-particle event. The polar-cap differential fluxes measured by OV1-17 and Injun-5 from 0.012 MeV to 1.1 MeV are well represented by a single power law. Over a 22 hour period the spectral index changed from 1.7 to 1.9. Temporal and spatial comparisons were made with data from the Explorer-35 and Injun-5 spacecraft. Good agreement is found at energies (300 keV) where a comparison can be made. Author (GRA)

N73-16967 Politecnico di Torino (Italy). Ist. di fisica Sperimentale.
THE QUASI-PERIODIC 6-DAY VARIATION IN COSMIC RAY INTENSITY [SULLA VARIAZIONE QUASI-PERIODICA DI CIRCA SEI GIORNI NELL'INTENSITA DELLA RADIAZIONE COSMICA]
Giuseppe Lovera *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 235-242 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-16801 Wisconsin Univ., Madison.
STATIC PHOTOIONIZATION MODELS FOR EMISSION LINE REGIONS OR QUASI-STELLAR OBJECTS AND SEYFERT GALAXIES Ph.D. Thesis
Gordon Madeira MacAlpine 1972 185 p
Avail: Univ. Microfilms Order No. 72-4287

Ionization and thermal equilibrium equations are solved for a gas cloud which is ionized by a source of ultraviolet radiation with the spectrum falling off slowly to higher frequencies as a power law. Elements considered are H, He, C, N, O, Ne, Mg, Si, S, and Fe. Basing the power-law input of ionizing radiation and other physical conditions in the gas, on observations for the quasi-stellar object 3C 273, sets of models are computed which examine how the gas is affected by changes in the spectral power-law index, filling factor, total nuclear density, helium abundance and absolute luminosity at the source. Results are discussed for the ionization and thermal structure of the gas along with predicted intensities for a number of emission lines. Results are also presented for two models in which the physical parameters of the gas are representative of conditions in the nucleus of the Seyfert galaxy NGC 4151. Dissert. Abstr.

N73-16802 New York Univ., N.Y.
REDSHIFT MAGNITUDE RELATIONS Ph.D. Thesis
Sheldon Eugene Kaufman 1971 71 p
Avail: Univ. Microfilms Order No. 72-13375

A closed formula for the relation between luminosity and redshift in an expanding Friedman universe is derived for the case of positive cosmological constant, positive space curvature, and vanishing pressure. This formula is then generalized to be valid for all values of the cosmological constant and the three possible space curvatures. The general formula is tested with the well known special cases. A completely similar procedure is followed for radiation filled world models. In the appendices, the Friedman equation is integrated using Jacobian elliptic functions, and an expression for the age of the universe is given in terms of Weierstrassian functions. Dissert. Abstr.

N73-16803 Illinois Univ., Urbana.
VENUS: MEASUREMENTS OF MICROWAVE BRIGHTNESS TEMPERATURES AND INTERPRETATIONS OF THE RADIO AND RADAR SPECTRA Ph.D. Thesis
William Wallace Warnock 1971 70 p
Avail: Univ. Microfilms Order No. 72-12425

Measurements of the brightness temperature and radar cross section of Venus at radio frequencies reveal a wealth of information concerning its atmospheric and subsurface properties. The subsurface contribution to the brightness temperature of Venus becomes more dominant over the atmospheric contribution as the wavelength of observation increases beyond about 6 cm. In order to improve the accuracy of the radio spectrum at these greater wavelengths, brightness temperature at four separate wavelengths in the range between 7.9 and 14.3 cm was measured. With the source 3C123 used as an absolute calibration standard, the brightness temperature of Venus is 679 + or - 46 K at 9.26 cm. Using 3C218 as an absolute calibration standard, brightness temperatures of 686 + or - 38 K at 7.89 cm, 675 + or - 41 K at 9.26 cm, 701 + or - 54 K at 12.0 cm, and 670 + or - 37 K at 14.3 cm were found. Dissert. Abstr.

N73-16804 California Univ., San Diego.
AN X-RAY SURVEY OF THE CYGNUS REGION IN THE 20 TO 300 keV ENERGY RANGE Ph.D. Thesis
James Leland Matteson 1971 83 p
Avail: Univ. Microfilms Order No. 72-13290

Cyg X-1 was observed in the 20 to 300 keV range on 10 June 1969 by a balloon-carried X-ray telescope. Factor two variations occurred on a five-minute time scale in the 17 to 31 keV range but did not extend to higher energies. On 17 July

1969 the Cygnus region was surveyed again. The flux in the 24 to 83 keV range is a factor seven below that of 10 June and is the lowest measured from Cyg X-1. These observations are inconsistent with Dolan's eclipsing binary model and together with other observations in May and June 1969 show that large variations occurred in the spectrum on a time scale of a week. The Cyg X-2 flux, 0.00066 photons (cm2-sec-keV) in the 24 to 52 keV range, confirms the presence of a hard spectrum component above the extrapolation of 1 to 10 keV spectra. The Cyg X-3 spectrum lies below previous measurements and confirms factor ten variations above 20 keV. Upper limits of 0.0006 photons (cm2-sec-keV) in the 24 to 52 keV range were established for Cyg X-4, the Cygnus Loop and Cygnus A. Dissert. Abstr.

N73-16805 Illinois Univ., Urbana.
INTERSTELLAR GRAVITATIONAL PERTURBATIONS OF COMETARY ORBITS Ph.D. Thesis
Marshall Barry Faintich 1971 126 p
Avail: Univ. Microfilms Order No. 72-12154

Two approximate analytic methods and one numerical method, namely a restricted hyperbolic three-body problem, were developed in order to handle the encounter of a star (or interstellar cloud) with the sun-comet system. It was found that encounters with objects whose velocities relative to the sun were at angles near 45 deg to the sun-comet line of apsides resulted in quite large perturbations of the cometary perihelion distance. During one period of revolution of a comet, close encounters by stars and interstellar clouds, although rare, occur often enough so that the majority of near-parabolic comets would be visible from the earth only once, unless further compensating perturbations change their orbits. It is hypothesized that over a long time period, the distribution of comets can be explained by a star streaming effect in a direction opposite to that of the solar motion. In a qualitative analysis, seven inequalities based on the encounter theories were established for the number of comets in various latitude zones of the solar motion coordinate system.
Dissert. Abstr.

N73-16806 California Inst. of Tech., Pasadena.
RELATIVISTIC VELOCITY-POTENTIAL HYDRODYNAMICS AND STELLAR STABILITY Ph.D. Thesis
Bernard Frederick Schutz, Jr. 1972 188 p
Avail: Univ. Microfilms Order No. 72-17650

The equations of relativistic, perfect-fluid hydrodynamics are cast in Eulerian form using six scalar velocity-potential fields, each of which has an equation of evolution. These equations determine the motion of the fluid. Einstein's equations and the velocity-potential hydrodynamical equations follow from a variational principle. These equations are also cast into Hamiltonian form. The second variation is used as the Lagrangian governing the evolution of small perturbations of differentially rotating stellar models. In Newtonian gravity this leads to linear dynamical stability criteria already known. In general relativity it leads to a new sufficient condition for the stability of such models against arbitrary perturbations. By introducing three scalar fields, the Newtonian stability criteria are greatly simplified for the purpose of practical applications. Dissert. Abstr.

N73-16807 Cornell Univ., Ithaca, N.Y.
STUDIES OF TERRESTRIAL PLANETS Ph.D. Thesis
Steven Laurence Soter 1971 142 p
Avail: Univ. Microfilms Order No. 72-9942

Four analyses of features of terrestrial planets and the moon are presented. The subjects discussed are: (1) the rotation and insolation of Mercury, (2) the role of tides in the resonant rotation and atmospheric circulation of Venus, (3) seismic propagation on the moon, and (4) the dust belts of Mars. Dissert. Abstr.

N73-16808 Cornell Univ., Ithaca, N.Y.
ROCKET SUBMILLIMETER OBSERVATIONS OF THE GALAXY AND BACKGROUND Ph.D. Thesis
Judith Lynn Pipher 1971 217 p
Avail: Univ. Microfilms Order No. 72-8988

Galactic and background radiation measurement by three rocket-borne submillimeter detectors are reported. Severe limitations on the possibility of emitting atoms or molecules within the galaxy causing far infrared background flux were established. Upper limits to the background were the 300 micron constraints on cosmological interpretations of the 1 mm data. Galactic emission at 100 micron at a flux level of eight times 10 to the minus 11 power watts/sq cm - sr was found in the anticenter direction. Emission decreased in intensity with increasing galactic latitude. Zodiacal dust emission at 100 micron was found to be at a level of two times 10 to the minus 11 power/watts/sq cm - sr at the ecliptic plane and is thought to represent emission by particles at 3 AU from the sun.
Dissert. Abstr.

N73-16809 Kentucky Univ., Lexington.
THE DETERMINATION OF BISMUTH IN METEORITES AND ROCKS BY NEUTRON ACTIVATION ANALYSIS Ph.D. Thesis
Patricia M. Santoliquido 1971 119 p
Avail: Univ. Microfilms Order No. 72-9414

Bismuth has been determined by alpha counting of the Po-210 daughter activity of the Bi-210 formed by thermal neutron activation. Results are presented for thirty chondrites, six achondrites, eight separated meteoritic phases, and six U.S. Geological Survey standard rocks. The majority of the meteorite analyses were done in replicate. The rock analyses were done in triplicate. This represents the first analyses for bismuth of meteorites in the chondrite classes: C4, H4, E5, E6, and LL6 and considerably expands the achondrite work. A number of trends which have been previously either noted or suspected by others have been further confirmed. The carbonaceous chondrites and ordinary chondrites show a decrease in bismuth content with increasing petrographic grade. The chalcophilic behavior of bismuth has been confirmed by correlation with sulfur content in the enstatite and ordinary chondrites. Dissert. Abstr.

N73-16810*# California Univ., Santa Barbara. Dept. of Physics.
THE GRAVITATIONAL FIELDS OF THE MAJOR PLANETS
S. J. Peale Jun. 1972 29 p refs
(Grant NGR-05-010-062)
(NASA-CR-130346) Avail: NTIS HC $3.50 CSCL 03B

The constraints placed on models of the interiors of the major planets by the nonspherical components of their gravitational fields are explained, and several methods of determining these nonspherical components are described and evaluated. Author

N73-16811*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
GAS ANALYSIS OF APOLLO 12, 14, AND 15 SAMPLES BY LASER-PROBE MASS SPECTROMETRY Final Report
George H. Megrue [1972] 54 p refs
(Grant NGR-09-015-144)
(NASA-CR-130029; Rept-211-092) Avail: NTIS HC $4.75 CSCL 03B

Solar wind gases, cosmogenic gases from high energy spallation reactions from soxmic rays, and radiogenic gases from decay of radioactive potassium and from uranium and thorium isotopes were analyzed in lunar materials. Details are presented on two aspects of the studies: (1) The spatial distribution of Ar-40/Ar-38 ages in lunar breccia 14301 was determined. The ages of clasts within this breccia are 3.68 + or - 0.09 and 2.9 + or - 0.3 x 10 to the 9th power years. Parentless radiogenic Ar-40 exists within the fine-grained matrix. (2) The distribution of helium, neon, and argon isotopes within Apollo 15 samples results primarily from fractionated solar wind gases, accompanied by small quantities of cosmogenic gases. Comparison of this Apollo 15 data with Kapoeta and Fayetteville meteorite and Apollo 12 and 14 data indicates that solar wind implantation followed by fractionation of the gases was primarily responsible for incorporation of original gas phase within solid bodies of the solar system. N.E.N.

N73-16812*# Missouri Univ., Rolla. Dept. of Chemistry.
NOBLE GASES IN THE MOON Annual Report
O. K. Manuel, B. Srinivasan, E. W. Hennecke, and D. E. Sinclair Sep. 1972 84 p refs
(Grant NGR-26-003-057)
(NASA-CR-130327) Avail: NTIS HC $6.25 CSCL 03B

The abundance and isotopic composition of helium, neon, argon, krypton, and xenon which were released by stepwise heating of lunar fines (15601.64) and (15271.65) were measured spectrometrically. The results of a composition of noble gases released from the lunar fines with noble gases in meteorites

and in the earth are presented along with the isotopic composition of noble gases in lunar fines, in meteorites, and in the atmosphere. A study of two isotopically distinct components of trapped xenon in carbonaceous chondrites is also included. F.O.S.

N73-16813*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF IMPACT CRATERING IN LUNAR-LIKE MATERIALS Final Report
N. L. Roy and J. C. Slattery Jan. 1973 131 p refs
(Contract NASw-2311)
(NASA-CR-130356; TRW-17433-6002-RO-00) Avail: NTIS HC $8.75 CSCL 03B

Electrostatically accelerated microparticles are used to perform simulated micrometeoroid impact cratering experiments in oligoclase. Impact craters were obtained using iron, lanthanum hexaboride, and silicon as the projectile materials. Each particle material was impacted at normal incidence and at 30 and 60 deg oblique angles. Tabular data for all impacts are presented and central crater pit diameter normalized to particle diameter and the total spall diameter normalized to particle diameter are plotted vs impact velocity for nine particle/angle combinations and three crystal orientations. Impact crater characteristics are photodocumented as a function of impact velocity for the nine particle/angle combinations and three crystal orientations in oligoclase and at fixed impact velocity for six other minerals. Author

N73-16814*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
STELLAR EVOLUTION OF HIGH MASS BASED ON THE LEDOUX CRITERION FOR CONVECTION
Richard Stothers and Chao-wen Chin [1972] 42 p refs
(NASA-TM-X-68914) Avail: NTIS HC $4.25 CSCL 03A

Theoretical evolutionary sequences of models for stars of 15 and 30 solar masses were computed from the zero-age main sequence to the end of core helium burning. During the earliest stages of core helium depletion, the envelope rapidly expands into the red-supergiant configuration. At 15 solar mass, a blue loop on the H-R diagram ensues if the initial metals abundance, initial helium abundance, or C-12 + alpha particle reaction rate is sufficiently large, or if the 3-alpha reaction rate is sufficiently small. These quantities affect the opacity of the base of the outer convection zone, the mass of the core, and the thermal properties of the core. The blue loop occurs abruptly and fully developed when the critical value of any of these quantities is exceeded, and the effective temperature range and fraction of the lifetime of core helium burning during the slow phase of the blue loop vary surprisingly little. At 30 solar mass no blue loop occurs for any reasonable set of input parameters. Author

N73-16815*# Aerospace Corp., El Segundo, Calif. Systems Planning Div.
ANALYSIS OF SPACE TUG OPERATING TECHNIQUES (STUDY 2.4). VOLUME 1: EXECUTIVE SUMMARY
Aug. 1972 35 p ref
(Contract NASw-2301)
(NASA-CR-130366; ATR-73(7314)-1-Vol-1) Avail: NTIS HC $3.75 CSCL 22A

The costs of tug refurbishment were studied, using existing cost estimating relationships, to establish the cost of maintaining the reusable third stage of the space transportation system. Refurbishment operations sheets which describe the actual tasks that are necessary to keep the equipment functioning properly were used along with refurbishment operations sheets which contain all of the pertinent descriptive information for each of the major vehicle areas. Tug refurbishment costs per mission are tabulated. F.O.S.

N73-16816*# Lowell Observatory, Flagstaff, Ariz.
HIGH RESOLUTION MEASURES OF POLARIZATION AND COLOR OF SELECTED LUNAR AREAS
Louise A. Riley and John S. Hall 7 Aug. 1972 17 p refs
(Grant NsG-45)
(NASA-CR-130018; Bull-159) Avail: NTIS HC $3.00 CSCL 03B

High resolution observations of intensity, color (UBV) and polarization were obtained with scanning techniques for a number of lunar areas of special interest, including boundaries of some of the brightest and darkest lunar regions, certain Apollo landing sites and prominent craters. Two dimensional raster scans of colors were obtained for Alphonsus, Aristarchus, and Herodotus. The degree of polarization for any given phase angle appears to be roughly indicative of age. The darker younger mare surface are more highly polarized than the lighter and older mare surfaces, which appear to be more contaminated by lighter material from the highlands or by ray material thrown out from fresh craters. All mare surfaces are more highly polarized than the still older and lighter terra regions surrounding the maria. The very oldest craters are either dark-floored and show polarization characteristics similar to those of the mare surfaces, or if located in the highlands, they are less and less distinguishable from the highland background with greater age, and show the general highland polarization characteristics. Author

N73-16817*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MOBILITY PERFORMANCE OF THE LUNAR ROVING VEHICLE: TERRESTRIAL STUDIES: APOLLO 15 RESULTS
Nicholas C. Costes, John E. Farmer, and Edwin B. George Washington Dec. 1972 87 p refs Presented at 4th Intern. Conf. of the Intern. Soc. for Terrain-Vehicle Systems, Stockholm and Kiruna, Sweden, 24-28 Apr. 1972
(NASA-TR-R-401; M451) Avail: NTIS HC $3.00 CSCL 13F

The constraints of the Apollo 15 mission dictated that the average and limiting performance capabilities of the first manned lunar roving vehicle be known or estimated within narrow margins. Extensive studies were conducted and are compared with the actual performance of the lunar roving vehicle during the Apollo 15 mission. From this comparison, conclusions are drawn relating to the capabilities and limitation of current terrestrial methodology in predicting the mobility performance of lunar roving vehicles under in-situ environmental conditions, and recommendations are offered concerning the performance of surface vehicles on future missions related to lunar or planetary exploration. Author

N73-16818# Bern Univ. (Switzerland).
NOBLE GAS INVESTIGATIONS OF LUNAR ROCKS 10017 AND 10071
P. Eberhardt, J. Geiss, H. Graff, N. Groegler, U. Kraehenbuehl, H. Schwaller, and A. Stettler Sep. 1972 63 p refs Submitted for publication
Avail: NTIS HC $5.25

The noble gases He, Ne, Ar, Kr, and Xe and also K and Ba were measured in the Apollo 11 igneous rocks 10017 and 10071, and in an ilmenite and two feldspar concentrates separated from rock 10071. Whole rock K/Ar ages of rocks 10017 and 10071 are (2350 + or - 60) million yr and (2880 + or - 60) million yr respectively. The two feldspar concentrates of rock 10071 have distinctly higher ages: (3260 + or - 60) million yr and (3350 + or - 70) million yr. These ages are still 10% lower than the Rb/Sr age obtained earlier and some Ar-40 diffusion loss must have occurred even in the relatively coarse grained feldspar. The relative abundance patterns of spallation Ne, Ar, Kr, and Xe are in agreement with the ratios predicted from meteoritic production rates. Diffusion loss of spallation He-3 is evident in the whole rock samples, and even more in the feldspar concentrates. The Kr-81/Kr exposure ages of rocks 10017 and 10071 are (480 + or - 25) million yr and (350 + or - 15) million yr respectively. Exposure ages derived from spallation Ne-21, Ar-38, Kr-83, and Xe-126 are essentially in agreement with the Kr-81/Kr ages. Author

N73-16819# Royal Greenwich Observatory, Herstmonceux (England).
THE APPLICATION OF OBJECTIVE GRATINGS TO FAINT STAR PHOTOMETRY
G. A. Harding, R. S. Harbour, and K. P. Tritton 1971 42 p refs
(Bull-172) Avail: NTIS HC $4.25; Roy. Greenwich Obs., Herstmonceux 65p

The use of an objective grating on a 74-inch telescope for the extension of magnitude sequences beyond those available photoelectrically is investigated. The existing two color photometry in omega Centauri and NGC 6397 is extended and in both cases the turn-off point from the main sequence is indicated. Author

N73-16820# Royal Greenwich Observatory, Herstmonceux (England).
AN ABUNDANCE ANALYSIS OF ALPHA CENTAURI
Valerie A. French and A. L. T. Powell 1971 42 p refs
(Bull-173) Avail: NTIS HC $4.25; Royal Greenwich Observatory, Herstmonceux; £0.60

The chemical composition of the components A and B of alpha Centauri has been examined. Abundances of twenty two elements have been determined from 921 and 1029 spectral lines respectively and both stars are found to have small overabundances of metals compared with the Sun. Author

N73-16821*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPUTER PROGRAM FOR MODELING NON-SPHERICAL ECLIPSING BINARY STAR SYSTEMS
D. B. Wood Dec. 1972 94 p refs
(NASA-TM-X-66155; X-110-72-473) Avail: NTIS HC $6.75 CSCL 03A

The accurate analysis of eclipsing binary light curves is fundamental to obtaining information on the physical properties of stars. The model described accounts for the important geometric and photometric distortions such as rotational and tidal distortion, gravity brightening, and reflection effect. This permits a more accurate analysis of interacting eclipsing star systems. The model is designed to be useful to anyone with moderate computing resources. The programs, written in FORTRAN 4 for the IBM 360, consume about 80k bytes of core. The FORTRAN program listings are provided, and the computational aspects are described in some detail. Author

N73-16822*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROVISIONAL HOURLY VALUES OF EQUATORIAL DST FOR JULY, AUGUST, AND SEPTEMBER 1972
M. Sugiura and D. J. Poros (Computer Sci. Corp., Silver Spring, Md.) Jan. 1973 6 p
(NASA-TM-X-66156; X-645-73-7) Avail: NTIS HC $3.00 CSCL 03C

Tables of provisional hourly values of equatorial Dst for July, August, and September 1972 are presented. E.H.W.

N73-16823*# Fordham Univ., New York.
APOLLO 15 TIME AND MOTION STUDY Final Report
Joseph F. Kubis, John T. Elrod, Rudolph Rusnak, and John E. Barnes Houston, Tex. NASA Jan. 1972 77 p
(Contract NAS9-11839)
(NASA-CR-128695; M72-4) Avail: NTIS HC $6.00 CSCL 22C

A time and motion study of Apollo 15 lunar surface activity led to examination of four distinct areas of crewmen activity. These areas are: an analysis of lunar mobility, a comparative analysis of tasks performed in 1-g training and lunar EVA, an analysis of the metabolic cost of two activities that are performed in several EVAs, and a fall/near-fall analysis. An analysis of mobility showed that the crewmen used three basic mobility patterns (modified walk, hop, side step) while on the lunar surface. These mobility patterns were utilized as adaptive modes to compensate for the uneven terrain and varied soil conditions that the crewmen encountered. A comparison of the time required to perform tasks at the final 1-g lunar EVA training sessions and the time required to perform the same task on the lunar surface indicates that, in almost all cases, it took significantly more time (on the order of 40%) to perform tasks on the moon. This increased time was observed even after extraneous factors (e.g., hardware difficulties) were factored out. Author

N73-16824*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODELS OF VENUS ATMOSPHERE (1972) Space Vehicle Design Criteria (Environment)
Sep. 1972 63 p refs
(NASA-SP-8011-Rev) Avail: NTIS HC $3.00 CSCL 03B

Criteria were developed in the following areas: environment, structures, guidance and control, and chemical propulsion. Quantitative data for the Venus atmosphere were obtained from earth-based observations and from spacecraft which have entered the Venus atmosphere or passed within several planetary radii of the planet. The models provide the temperature, pressure, and density profiles required to perform basic aerodynamic analyses. A set of engineering models are provided for the Venus atmosphere, based on theory and measured data available in January 1972. J.A.M.

N73-16825*# Fordham Univ., New York.
APOLLO 16 TIME AND MOTION STUDY Final Mission Study
Joseph F. Kubis, John T. Elrod, Rudolph Rusnak, John E. Barnes, and Susan C. Saxon Jul. 1972 71 p
(Contract NAS9-11839)
(NASA-CR-128696; M72-6) Avail: NTIS HC $5.75 CSCL 22C

A time and motion study is presented of astronaut lunar surface activity on Apollo 16 which consists of five distinct analyses: an evaluation of lunar mobility, a comparison of task performance in 1-g training and lunar EVA, a study of metabolic costs and adaptation, a discussion of falls, and retrieval of fallen objects. Two basic mobility patterns, the hop or canter and the traditional walking gait, were consistently utilized in longer traverses. The metabolic rates associated with these two mobility types, each used by a different astronaut, were relatively equivalent. The time to perform tasks on the lunar surface was significantly longer (on the order of 70%) than the time to perform the same tasks during the last 1-g training session. These results corroborated the findings on Apollo 15 and were not significantly different from them. There was general improvement in lunar EVA performance upon repetition of tasks. Metabolic rate (BTU/hr.) and metabolic cost (BTU) decreased over successive EVAs. Specifically, the metabolic rate associated with riding the lunar roving vehicle (LRV) decreased by approximately 18% from EVA 1 to EVA 2 and by 15% from EVA 2 to EVA 3. Author

N73-16826*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET PHOTOMETRY FROM THE ORBITING ASTRONOMICAL OBSERVATORY. 8: THE BLUE Ap STARS
David S. Leckrone Jan. 1973 49 p refs Submitted for publication
(NASA-TM-X-66163; X-671-73-13) Avail: NTIS HC $4.50 CSCL 03A

The filter photometers in the Wisconsin Experiment Package on OAO-2 were used to obtain data for a carefully selected set of 24 blue Ap stars and 31 comparison standard B and A dwarfs and giants for a program of relative photometry. Observations were made in seven bandpasses over the effective wavelength range 1430A-4250A. The Ap stars observed include members of the Si, Hg-Mn and Sr-Cr-Eu peculiarity classes. Most of them are too blue in B-V for their published MK spectral classes. The blue Ap stars are markedly deficient in emitted ultraviolet flux and are underluminous as compared to normal stars with the same UBV colors. The Hg-Mn stars appear less flux deficient in the ultraviolet for their UBV colors than do Si or Sr-cr-Eu stars. Most of the Ap stars observed possess ultraviolet flux distributions, or ultraviolet color temperatures, consistent with their published MK spectral classes to well within the classification uncertainties. Author

N73-16827*# Linguistic Systems, Inc., Cambridge, Mass.
THE FUTURE BELONGS TO ASTROPHYSICS
L. A. Artsimovich Washington NASA Feb. 1973 9 p ref Transl. into ENGLISH from Priroda (Moscow), no. 9, Sep. 1972 p 2-4
(Contract NASw-2482)
(NASA-TT-F-14670) Avail: NTIS HC $3.00 CSCL 03B

A general history of the development of physics is reported in particular nuclear physics and astrophysics. Prospects for future development in astrophysics are discussed and increased Soviet efforts in this area are projected. Author

N73-16828*# Scientific Translation Service, Santa Barbara, Calif.
NEW INVESTIGATIONS OF THE OPTIMUM RENDEZVOUS MANEUVER OF SPACE VEHICLES ON ELLIPTICAL TRAJECTORIES FOR MINIMUM FUEL CONSUMPTION
Alexe Marinescu, Stefan Staicu, and Vladimir Cardos Washington NASA Jan. 1973 24 p refs Transl. into ENGLISH from Z. Flugwiss (Germany), v. 20, Apr. 1972 p 146-154

(Contract NASw-2483)
(NASA-TT-F-14644) Avail: NTIS HC $3.25 CSCL 22A

Based on the general formulation of the variational problem for the rendezvous maneuver on arbitrary conic section trajectories, the rendezvous maneuver was investigated for minimum fuel consumption on elliptical trajectories. The solutions for the optimum motion of the propelled spacecraft are emphasized. It is shown by numerical calculation for the optimum rendezvous maneuver for four different elliptical flight trajectories that the thrust acceleration components are linear for small burning time, and that the eccentricity of the flight trajectories influence the relative accleration more than the thrust. F.O.S.

N73-16829# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 292
15 Jan. 1973 39 p Transl. into ENGLISH from Russian reports (JPRS-57989) Avail: NTIS HC $4.00

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N73-16830*# Translation Consultants, Ltd., Arlington, Va.
ONE PRINCIPAL FOR THE OPERATION OF AN ORBITAL ASTRONOMICAL OBSERVATORY CONTROLLED BY A COSMONAUT
G. A. Gurzadyan Washington NASA Jan. 1973 7 p Transl. into ENGLISH from Soobshch. Byurakansk. Obs. (USSR), no. 45, 1972 p 5-11
(Contract NASw-2038)
(NASA-TT-F-14580) Avail: NTIS HC $3.00 CSCL 03A

The problem of obtaining high precision astronomical observations using an astrophysical observatory installed in a multipurpose orbital station and manned by a cosmonaut who is not a professional astronomer is dealt with. The principal concern is to level the telescope, or telescopes, outside the spacecraft at the proper star without programmed assignment when the spacecraft is more or less arbitrarily oriented with respect to the sky. The problem is solved by using an additional optical aiming tube set against one of the ports in the spacecraft and by introducing a primary follow-up system of rough sighting between the aiming tube and the telescope. The cosmonaut levels the aiming tube at the proper star and the primary system points the telescope at the same star with an accuracy of - or + 0.5. This is sufficient for the proper star to be caught by the photoguide, set on the telescope, which automatically tracks the star with high precision. Author

N73-16831*# Translation Consultants, Ltd., Arlington, Va.
SPECTROGRAMS OF ALPHA LYRAE AND BETA CENTAURI IN THE RANGE OF 2000-3800 ANGSTROMS
V. I. Patsayev Washington NASA Jan. 1973 8 p refs Transl. into ENGLISH from Soobshch. Byurakansk. Obs. (USSR), no. 45, 1972 p 20-26
(Contract NASw-2038)
(NASA-TT-F-14582) Avail: NTIS HC $3.00 CSCL 03A

The orbital station Salyut produced six spectrograms of beta Centauri (18 June 1971) and nine spectrograms of alpha Lyrae (21 June 1971) in the range of 2000 to 3800 A. The spectrograms were received with the help of the observatory Orion installed on the external surface of the Salyut and remotely controlled by the cosmonaut from within. The spectrograms were obtained photographically on a film with spectral resolution of about 5 A on 2600 A. After completing the program of observations the cassette containing the film with the pictures was delivered to the earth where the spectrograms were developed. Laboratory standards essential for plotting the characteristic curve were taken on pieces of film returning from space. After two months' orbiting in outer space the latter proved to be quite fogged. Most of the spectrograms of alpha Lyrae and beta Centauri obtained were overexposed. Author

N73-16832*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
MAGNETOSPHERIC ELECTRON DENSITY MEASUREMENTS FROM UPPER HYBRID RESONANCE NOISE OBSERVED BY IMP-6
Robert R. Shaw and Donald A. Gurnett Dec. 1972 45 p refs (Contract NAS5-11074; Grant NGL-16-001-043; Contract N00014-68-A-0196-0003)
(NASA-CR-130273; U-of-Iowa-72-37) Avail: NTIS HC $4.25 CSCL 03B

A band of natural radio noise between the local electron plasma frequency and the upper hybrid resonance frequency is observed by the IMP-6 satellite. The band exists over a large range of geocentric radial distances extending from inside the plasmapause boundary to greater than 10 earth radii in the outer magnetosphere. The center frequency of the noise band decreases with increasing radial distance, and changes abruptly at the plasmapause boundary. The broadband electric field strength of this noise is very small, seldom exceeding 10 microvolts/meter, and probably could not be detected without using long electric antennas of IMP-6. It is believed that this noise is produced by incoherent Cerenkov emission from super-thermal electrons. In some cases a second very narrow noise band was observed at a frequency slightly above the second harmonic of the electron gyrofrequency. Author

N73-16833*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MIE SCATTERING OF THE INTERPLANETARY MAGNETIC FIELD BY THE WHOLE MOON
C. P. Sonett and D. S. Colburn Jan. 1973 27 p refs
(NASA-TM-X-62225) Avail: NTIS HC $3.50 CSCL 03B

It is known from the Apollo magnetometer experiments that significant electromagnetic induction takes place in the lunar interior. This induction is excited by fluctuations of the interplanetary magnetic field and is detected by the induced fields on the surface of the moon. These results are reviewed briefly and the formal properties of the theory are discussed. It is shown that the mathematical treatment parallels that for classical electromagnetic scattering. Further the wavelength spectrum of the fluctuations of the interplanetary magnetic field include scales consistent with the radius of the moon. The consequence is that the moon is excited in several modes. Quadrupole and possibly octupole magnetic multipoles are found in the data. The electric type radiation corresponding to transverse magnetic excitation appears suppressed and far below the detection threshold of the magnetometers. Author

N73-16834*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NIGHTSIDE ELECTROMAGNETIC RESPONSE OF THE MOON
G. Schubert (Calif. Univ), B. F. Smith, C. P. Sonett, D. S. Colburn, and K. Schwartz Oct. 1972 41 p refs
(Contract NAS2-6876)
(NASA-TM-X-62226) Avail: NTIS HC $4.25 CSCL 03B

The electromagnetic response of the Moon to excitation by the time dependent fluctuations of the interplanetary magnetic field is given for the dark or antisolar hemisphere of the Moon. Six hours of time series data from the Explorer 35 magnetometer and the lunar surface magnetometer on Apollo 12 are used to obtain the Fourier spectral amplitudes of the surface and interplanetary fields from which transfer functions are calculated for the east-west, north-south, and vertical directions at the Apollo site. A critical discussion of lunar conductivity profiles derived from night side radial magnetic field data and vacuum scattering theory is presented. Limitations are shown that there is no evidence for a lunar core as conducting as 0.01 mhos/m. Author

N73-16835*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE PROGRAM PAYLOAD COSTS AND THEIR POSSIBLE REDUCTION
Edgar M. VanVleck, Jerry M. Deerwebster, Susan M. Norman, and Larry R. Alton Washington Jan. 1973 68 p refs
(NASA-TM-X-62223) Avail: NTIS HC $5.50 CSCL 22A

The possible ways by which NASA payload costs might be reduced in the future were studied. The major historical reasons for payload costs being as they were, and if there are technologies (hard and soft), or criteria for technology advances, that could

significantly reduce total costs of payloads were examined. Payload costs are placed in historical context. Some historical cost breakdowns for unmanned NASA payloads are presented to suggest where future cost reductions could be most significant. Space programs of NOAA, DoD and COMSAT are then examined to ascertain if payload reductions have been brought about by the operational (as opposed to developmental) nature of such programs, economies of scale, the ability to rely on previously developed technology, or by differing management structures and attitudes. The potential impact was investigated of NASA aircraft-type management on spacecraft program costs, and some examples relating previous costs associated with aircraft costs on the one hand and manned and unmanned costs on the other are included. Author

N73-16836*# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
LUNAR LIBRATION POINT FLIGHT DYNAMICS STUDY Final Report, May - Nov. 1968
Apr. 1969 132 p refs
(Contract NAS5-11551)
(NASA-CR-130135) Avail: NTIS HC $8.75 CSCL 22A

Two satellite concepts, Halo and Hummingbird, for a lunar libration point satellite to be used as a tracking and communications link with the far side of the moon were evaluated. Study areas included flight dynamics, communications, attitude control, propulsion, and system integration. Both concepts were proved feasible, but Halo was shown to be the better concept. Author

N73-16837*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPOSITIONS OF MAJOR AND MINOR MINERALS IN FIVE APOLLO 12 CRYSTALLINE ROCKS
Bevan M. French, K. F. J. Heinrich (NBS), Paul D. Loman, Jr., Arthur S. Doan, Jr., Isidore Adler, and Louis S. Walter Washington 1972 145 p refs Original contains color illustrations
(NASA-SP-306) Avail: NTIS HC $3.00 CSCL 08G

The complete analytical results obtained on polished thin sections of five Apollo 12 lunar samples are presented. The samples are (12004,9) (12018,6), (12021,142), (12040,47), and (12051,60). The Apollo 12 site, though nominally on an irregular mare, is actually on a largely terra-enclosed area only 70 kilometers north of the north edge of Mare Cognitum. The samples are inferred to be derived from the mare bedrock within approximately 1/2 km of the landing site. They represent lava flows or shallow intrusives emplaced at depths of less than 100 m. Author

N73-16838*# National Aeronautics and Space Administration, Washington, D.C.
THE PROBLEM OF SPACE VEHICLE DESCENT IN PLANETARY ATMOSPHERES
N. M. Ivanov and A. I. Martynov Feb. 1973 51 p refs Transl. into ENGLISH of the book "Problemaspuska Kosmicheskikh Apparatov v Atmosferakh Planet" Moscow, Znaniye Press, 1972 p 5-47
(NASA-TT-F-768) Avail: NTIS HC $3.00 CSCL 22A

An attempt was made to solve the problems of space vehicle entry and descent into the planetary atmospheres of Mars, Jupiter, and Venus. Data cover atmospheric composition and density, planetary temperature, and physical properties of planet surface. Problems with high accelerations, pressures, and temperatures on vehicle thermal shielding are also covered. E.H.W.

N73-16839*# National Aeronautics and Space Administration, Washington, D.C.
THE MOON AND THE PLANETS (SPACE PROGRAM)
V. P. Denisov and V. I. Alimov Feb. 1973 44 p Transl. into ENGLISH of the book "Luna i planety (Kosmicheskaya programma)" Moscow Znaniye Press, 1971 p 3-32
(NASA-TT-F-767) Avail: NTIS HC $3.00 CSCL 03B

Study of the Moon and the planets nearest the earth, using space vehicles is considered. Information known to science today is presented concerning our closet neighbors, planets of the solar system, and the flights of space stations to the Moon, Mars, and Venus, and the role of man in the exploration and exploitation of space and the immediate objectives in exploration of the solar system. Author

N73-16840# European Southern Observatory, Hamburg (West Germany).
THE ROLE OF SCHMIDT TELESCOPES IN ASTRONOMY
Ulrich Haug, ed. Oct. 1972 172 p refs Partly in ENGLISH and partly in FRENCH Conf. held at Hamburg, 21-23 Mar. 1972 Sponsored partly by Sci. Res. Council
Avail: NTIS HC $10.75

Schmidt telescope observational programs in both the Northern and Southern hemispheres and technical developments that may further widen the range of observational possibilities are reported. The role of Schmidt telescopes in the study of galactic structure, external galaxies, quasars, astrometry and objective prism work is emphasized. For individual titles, see N73-16841 through N73-16860.

N73-16841 California Univ., Berkeley. Radio Astronomy Lab.
TWENTY YEARS ASTRONOMY WITH THE 48-INCH SCHMIDT TELESCOPE ON PALOMAR MOUNTAIN
R. Minkowski *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 5-8 (For availability see N73-16840 07-30)

A brief history is given of the use of the 48-inch Schmidt telescope on Palomar Mountain compared with the 200-inch telescope. The technical improvements are considered and investigations into the red shift of galaxies and radio sources are described. Author (ESRO)

N73-16842 Basel Univ. (Switzerland). Astronomisches Inst.
THE ROLE OF SCHMIDT TELESCOPES IN THE STUDY OF GALACTIC STRUCTURE (PHOTOMETRIC METHODS)
W. Becker *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 9-29 refs (For availability see N73-16840 07-30)

Methods and results of photometry with Schmidt telescopes in the field of galactic structure are discussed. The methods of three-color photometry are shown to be the most powerful since they yield the data necessary for the determination of the structure - absolute magnitude, interstellar reddening, population membership - even at large distances and down to very faint stars. Up to the present time three-color photometry on Schmidt plates has been applied mainly to four topics of stellar statistics - galactic clusters, distribution of stars in the galactic disk, distribution of stars in the galactic halo, and white objects in high galactic latitudes, and these applications are discussed in detail.
Author (ESRO)

N73-16843 Minnesota Univ., Minneapolis.
ASTROMETRY WITH SCHMIDT TELESCOPES c14
W. J. Luyten and A. E. LaBonte *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 33-38 refs (For availability see N73-16840 07-30)

Two types of astrometry using the 48-inch Palomar Schmidt telescope are discussed - the determination of so-called absolute positions for stars from Schmidt plates, and the determination of relative motions within a very small area of the plate. In each case tests concerning the accuracy of the determination as well as the accuracy inherent in the measuring instrument are described. Author (ESRO)

N73-16844 Hamburger Sternwarte (West Germany).
COMPUTATIONAL SOLUTION FOR POSITIONS ON WHOLE SCHMIDT PLATES: REPORT ON REDUCTION OF COORDINATES MEASURED ON 22 PLATES OF THE BERGEDORF SCHMIDT TELESCOPE
W. Dieckvoss *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 39-43 (For availability see N73-16840 07-30)

Extensive use of smaller areas of the whole Schmidt plate field for the determination of stellar positions yields excellent results. The method is briefly described in its application to the reduction of coordinates measured on 22 plates of the Bergedorf Schmidt telescope. Author (ESRO)

N73-16845 Strasbourg Univ. (France). Observatoire Astronomique.
USE OF THE SCHMIDT TELESCOPE FOR ASTROMETRY [EMPLOI DU TELESCOPE DE SCHMIDT EN ASTROMETRIE] c14

P. Bru and P. Lacroute *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 45-49 refs In FRENCH (For availability see N73-16840 07-30)

After describing the principle advantages of Schmidt plates (image quality and reduction) the correspondence between flat and curved plates is discussed. In order to examine the astrometric possibilities of a Schmidt telescope, experiments were carried out with a curved plate 30 x 30 cm square and 1 mm thick. A photographic study, the aim of which is to see if a law of correspondence between flat and curved plates can be obtained, is also described. Author (ESRO)

N73-16846 Warner and Swasey Observatory, Cleveland, Ohio.
OBJECTIVE-PRISM SPECTRAL WORK c14
W. P. Bidelman *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 53-60 refs (For availability see N73-16840 07-30)

The advantages and disadvantages of the objective prism approach to stellar spectroscopy as compared with the slit spectrography approach are considered. The work done with the objective prism and Schmidt telescopes is discussed and for this purpose is divided into two categories - sky surveys and work on objects about which something significant is already known. Novel techniques using objective prisms are suggested. Author (ESRO)

N73-16847 Bonn Univ. (West Germany). Astronomische Inst.
A PROPOSAL FOR A FLINT OBJECTIVE PRISM FOR THE ESO SCHMIDT CAMERA c14
E. H. Geyer *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 61-62 (For availability see N73-16840 07-30)

Various glasses for the objective prism of the ESO Schmidt camera are compared for their efficiency and it is concluded that flint glass offers the best light transmission. Author (ESRO)

N73-16848 Instituto Venezolano de Astronomia, Merida.
RADIAL VELOCITIES FROM OBJECTIVE PRISM PLATES c14
J. Stock and W. Osborn *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 63-64 (For availability see N73-16840 07-30)

A method is described for the determination of radial velocities by a Schmidt telescope equipped with objective prism plates. The method is based on the comparison of plates taken of the same object with dispersions in opposite directions; it can be extended to the use of several spectral lines. Author (ESRO)

N73-16849 Toronto Univ. (Ontario). David Dunlop Obs.
THE ROLE OF SCHMIDT TELESCOPES IN THE STUDY OF EXTERNAL GALAXIES
S. VandenBergh *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 67-76 refs (For availability see N73-16840 07-30)

One of the major advantages of the Schmidt telescope for extragalactic investigations is that it allows the study of galaxies as members of their celestial environment. This application is discussed together with the correlation between the structure and luminosity of spirals as revealed by an inspection of the images of spiral galaxies in clusters. The recent introduction of iiia-j emulsion which has vastly extended the power of existing Schmidt telescopes is considered, and the study of quasars using Schmidt telescopes is reviewed. Infrared searching for nuclei and hot spots in galaxies is described and the evolution of galaxies discussed. It is concluded that large Schmidt telescopes can contribute significantly to the study of galaxies. Author (ESRO)

N73-16850 Observatoire de Paris-Meudon (France).
OBSERVATIONS OF QUASARS WITH SMALL SCHMIDT TELESCOPES
P. Veron *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 77-79 ref (For availability see N73-16840 07-30)

Using three small Schmidt telescopes variable quasars and the radio source BL Lacertae were monitored. Details of the telescopes are given in an accompanying table. A light curve of BL Lacertae was built using 1387 measurements. Part of this result is reproduced in a figure. Author (ESRO)

N73-16851 Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Radio Physics.
SCHMIDT TELESCOPES AND RADIO ASTRONOMY
J. G. Bolton *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 81-85 (For availability see N73-16840 07-30)

The importance of Schmidt telescopes to radio astronomy is discussed and it is pointed out that radio astronomy and the Palomar sky survey have been the dominating factors in the vast changes in extragalactic knowledge in the past twenty years. Progress in investigation of radio sources is outlined and the use of two color plates in the identification of quasars is described. Opinions on how the sky survey for the Southern Hemisphere should be conducted to offer the maximum advantages for extragalactic research are expressed. Author (ESRO)

N73-16852 Northwestern Univ., Evanston, Ill. Dept. of Astronomy.
SURFACE COLOUR PHOTOMETRY OF GALAXIES WITH SCHMIDT TELESCOPES c14
J. D. Wray *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 87-96 refs Sponsored in part by UK Sci. Res. Council and European Southern Obs. (For availability see N73-16840 07-30)

A photometric method is presented which owes its practicality to the capability of Schmidt telescopes to record a number of galaxy images on a single plate and to the existence of high speed computer controlled area-scanning precision microdensitometers. A number of galaxy images are recorded on several Schmidt plates, each of which has a filter-emulsion combination which is sensitive to a particular wavelength region, such as U, B, V. Among the different galaxies imaged on the plates one or more is selected to provide the photometric standard. The surface brightness distribution of the standard galaxy is used to calibrate density versus intensity above sky background. This calibration is then applied to microdensitometric scans of other galaxies on the plate to determine their detailed brightness distributions. Color index images of Virgo cluster galaxies are shown. Author (ESRO)

N73-16853 Dunsink Observatory, Dublin (Ireland).
THE USE OF SCHMIDT TELESCOPES IN THE SOUTHERN HEMISPHERE
P. A. Wayman *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 101-105 (For availability see N73-16840 07-30)

The special properties of Schmidt telescopes are discussed and the type of work which can be undertaken within these characteristics described. The question of sites for optical observatories in the Southern Hemisphere is considered and objects requiring the attention of Schmidt telescopes are discussed with emphasis on the Magellanic clouds. Author (ESRO)

N73-16854 Wuerzberg Univ. (West Germany). Astronomisches Inst. und Sternwarte.
A BLUE-INFRARED SURVEY OF THE SKY SOUTH OF -36 DEG
H. Haffner *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 107-108 refs (For availability see N73-16840 07-30)

A sky survey in the Southern Hemisphere south of -36 deg with the purpose of finding late M stars is described. Using a Schmidt telescope the area was covered with blue and infrared films which were evaluated in a blink comparator. 2330 stars were listed of which 323 are believed to be late M or highly reddened stars. Author (ESRO)

N73-16855 Bonn Univ. (West Germany). Astronomische Inst.
IDENTIFICATION OF SELECTED IRC-OBJECTS
W. Wiemer *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 111-112 refs (For availability see N73-16840 07-30)

An infrared identification program using Schmidt telescopes, infrared photometry, and slit spectra, is described for 285 stars in the Northern Hemisphere for which no previous identifications have been given. Author (ESRO)

N73-16856 Smith Coll., Northampton, Mass.
FIVE SCHMIDT TELESCOPE PROGRAMMES IN PROGRESS AND IN PLANNING
Waltraut C. Seitter *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 113-116 (For availability see N73-16840 07-30)

Five Programs using Schmidt telescopes are described. These are: The compilation of parts 2 and 3 of the Boon spectral atlas, which will include respectively stellar spectra of types in the 1953 MK catalog, and stellar spectra of very early, very late, and peculiar types; the preparation of an atlas of Nova Delphini 1967; investigations of normal type stars and galactic structure; and statistics of large radial velocities of galaxies.
Author (ESRO)

N73-16857 Dudley Observatory, Albany, N.Y.
GALACTIC STRUCTURE AT HIGH GALACTIC LATITUDES
A. G. D. Philip *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 f 117-126 refs Sponsored in part by NSF and SUNY Res. Found. (For availability see N73-16840 07-30)

Stellar density distributions and stellar luminosity functions in areas of high galactic latitudes are used to determine, in three dimensions, the tilts of lines of equal stellar density within a few kiloparsecs of the sun. The survey, using Schmidt telescopes, yields more accurate stellar density distributions than before since attention is paid to the accurate determination of interstellar reddening and photoelectric photometry is being obtained for all early-type stars found. Author (ESRO)

N73-16858 Arizona Univ., Tucson. Optical Sciences Center.
AURA SCHMIDT TELESCOPE PROGRAMME c14
R. Buchroeder and R. Lynds (Kitt Peak Natl. Obs.) *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 127-134 (For availability see N73-16840 07-30)

Preliminary optical design work for large Schmidt telescopes is summarized with emphasis on the angular resolution and the achromatic corrector. The feasibility of converting the telescope to a Cassegrain configuration is also discussed. Author (ESRO)

N73-16859 European Southern Observatory, Hamburg (West Germany).
THE ESO SCHMIDT TELESCOPE c14
O. Heckmann *In its* The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 137-139 (For availability see N73-16840 07-30)

A brief description is given of the parameters and components (mirror, objective prism, corrector, tube, etc.) of the ESO Schmidt telescope. Author (ESRO)

N73-16860 Deutsche Akademie der Wissenschaften, Berlin (East Germany). Zentral inst. fuer Astrophysik.
TEN YEARS OF RESEARCH WITH THE 134-CM SCHMIDT TELESCOPE
N. Richter *In* European Southern Obs. The Role of Schmidt Telescopes in Astronomy Oct. 1972 p 141-143 (For availability see N73-16840 07-30)

The instrument efficiency of the 134 cm Schmidt telescope at Tautenburg is discussed from the point of view of optical image concentration demand from Hartmann tests in three spectral regions; viewing conditions and limiting magnitudes in photographic work are considered. Research programs and work already completed are also briefly mentioned. Author (ESRO)

N73-16861# Scientific Translation Service, Ann Arbor, Mich.
BUILDER OF COSMIC ISOTOPES IN IRON METEORITES
V. S. Barashenkov, N. M. Sobolevskii, and V. D. Toneev [1972] 9 p refs Transl. into ENGLISH from Russian report JINR-P2-6225 Prepared for ORNL Sponsored by AEC
(ONRL-tr-2620; JINR-P2-6225) Avail: NTIS

The formation rates of cosmogenic isotopes Na-22Cl-36 K-40, and V-49 in iron meteorites were calculated using the Monte Carlo method. The question about variations of the cosmic ray intensities is discussed. Preatmospheric radius of the Arus-Yardymlinsky meteorite is estimated. The results were compared with those obtained by other authors. Author (NSA)

N73-16862# Arbeitsgruppe fuer Physikalische Weltraumforschung, Freiburg (West Germany).
SOLAR OBSERVATIONS AND RESEARCH BY MEANS OF ROCKETS [SONNENBEOBACHTUNG UND -FORSCHUNG MIT RAKETEN]
G. Schmidtke Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Aug. 1972 126 p refs Partly in GERMAN and partly in ENGLISH Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-72-27) Avail: NTIS HC $8.50; DFVLR, Porz, West Ger. 26,10 DM

A survey is given of current space programs for solar research and observation in Germany. Special projects such as the spectro-stratoscope, X-ray imaging of the sun, high resolution XUV-spectroscopy with diffraction filter techniques, etc., are discussed. Significant future solar research projects are outlined, and international research projects, such as ATM, OSO, and HELIOS, are considered. The technical possibilities of available solar pointing controls are reviewed. Recommendations for the national research program are given. Author (ESRO)

N73-16863# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ON THE POSSIBILITY OF A RESONANCE CAPTURE OF THE ASTEROID TORO BY THE EARTH
Lars Danielsson and Ramesh Mehra Aug. 1972 20 p ref
(TRITA-EPP-72-19) Avail: NTIS HC $3.00

Among the very few tabulated asteroids with perihelium inside the earth's orbit (Apollo asteroids) some have periods nearly commensurable with the earth's. The perturbed orbit of one of these, 1685 Toro, was integrated over 1200 years. The results show that Toro is at present captured in resonance with the earth and that also Venus has a drastic influence on the orbital elements. Author (ESRO)

N73-16864# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept d'Etudes et de Recherches en Technologie Spatiale.
SCANNING ELECTRON MICROSCOPE AND ENERGY DISPERSIVE X-RAY ANALYSIS OF THE SURFACE FEATURES OF SURVEYOR 3 TELEVISION MIRROR
J. C. Mandeville Dec. 1972 22 p refs
(ONERA-NT-01-15) Avail: NTIS HC $3.25

The Surveyor 3 television camera mirror was examined for micrometeoroid Impact sites. Optical and scanning electron microscope analysis shows that the mirror surface is covered with a homogeneous dust layer of lunar origin. The concentration of pits on the mirror surface increases from the bottom to the top of the mirror, and reaches a value of 1 million per sq cm. The shape and the orientation of most of the pits (75% smaller than 4 microns) show that they were caused by low velocity particles striking the mirror surface at an oblique or grazing angle and coming from a source below the mirror. A flux limit of 0.01 per sq m per sec (1/2 Pi steradians) for particles with masses larger than 10 to the minus 13th power g was found.
ESRO

N73-16865# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
EXACT ANALYTICAL SOLUTIONS FOR ORBITS OF BODIES WITH ATMOSPHERIC DRAG
Morris Morduchow and Giuseppe Volpe Jun. 1972 20 p refs
(Contract F44620-71-C-0008; AF Proj. 9781)
(AD-751491; PIBAL-72-21; AFOSR-72-2145TR) Avail: NTIS CSCL 22/3

Exact analytical solutions, by an inverse type of method, are derived for the motion of a particle under a central Newtonian gravitational force and an atmospheric drag force proportional to the square of the speed. In these solutions a form of the orbit is assumed, and the corresponding required atmospheric density, as a function of height, is determined. Some simple specific examples are furnished to illustrate such exact solutions for the entire motion of a satellite including both its orbital decay phase and its planetary entry phase. In one of these examples the required atmospheric density distribution closely approximates, at least in the orbital decay phase, isothermal models frequently assumed for actual planetary atmospheres.
Author (GRA)

N73-16970 Istituto Universitario Navale, Naples (Italy).
CYCLOIDS OF CONSTANT AZIMUTH [CICLOIDI DI EGUALE AZIMUT]
Antonino Sposito *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 261-267 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

N73-16971 Istituto Universitario Navale, Naples (Italy).
THEORETICAL FORMULATION OF A CELESTIAL NAVIGATION METHOD [IMPOSTAZIONE TEORICA DI UN METODO DI NAVIGAZIONE ASTRONOMICA]
Giancarlo Lucarelli *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 269-277 In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

N73-16972 Istituto Universitario Navale, Naples (Italy).
THE MOST PROBABLE POSITION IN THE ASTRONOMICAL NAVIGATION WITH FICTITIOUS CELESTIAL BODIES [PUNTO PIU PROBABILE IN NAVIGAZIONE ASTRONOMICA CON ASTRI FITTIZI]
Aniello Russo *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 279-286 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

N73-16973 Istituto Universitario Navale, Naples (Italy).
AN APPLICATION OF KALMAN FILTERING TO THE ASTRONOMICAL POSITION DETERMINATION BY ALTITUDE MEASUREMENT [UN'APPLICAZIONE DEL FILTRO DI KALMAN ALLA DETERMINAZIONE ASTRONOMICA DELLA POSIZIONE CON RETTE D'ALTEZZA]
Vincenzo Nastro *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 287-293 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N73-16866* National Aeronautics and Space Administration, Washington, D.C.
LAUNCH VEHICLE ESTIMATING FACTORS FOR ADVANCED MISSION PLANNING
1973 221 p refs Previously announced as NHB-7100.5; N71-19310
(NHB-7100.5B; NHB-7100.5) Avail: NASA Headquarters, Washington, D. C. Attn: Code DHA CSCL 22B

Mission characteristics and launch vehicle capability data for future mission planning and launch vehicle requirement estimates are reported. New information is presented on the drift of Sun synchronous orbits. Planetary launch opportunity data have been extended to the end of the century. Revised data are presented for the space shuttle and other launch vehicles. recent charges of the nomenclature for Delta launch vehicles are incorporated. G.G.

N73-16867 Maryland Univ., College Park.
MINIMUM FUEL ATTITUDE CONTROL AND STABILIZATION OF AN INERTIALLY ORIENTED SPACE STATION Ph.D. Thesis
John Joseph Fearnsides 1971 168 p
Avail: Univ. Microfilms Order No. 72-12750

Using Newtonian Mechanics, a mathematical model is derived to represent small motions relative to an inertial reference coordinate system of a large, unsymmetrical, rigid spacecraft in low, circular earth-orbit. The resulting system equation is a set of coupled, linear differential equations with periodic coefficients and periodic forcing functions. The first main result of this research is the development of the zero-fuel mode; a three-axis oscillatory motion corresponding to the unique, forced periodic solution of the system equation. This motion is then used in lieu of the point $x = 0$ as a target set for the development of a control law. It is called the zero-fuel mode because, (assuming an ideal, deterministic system) once the state of the system is properly initialized by the thrusters no further control action is required. Dissert. Abstr.

N73-16868 Colorado Univ., Boulder.
PARAMETRIC RESONANCE MECHANISMS IN CROSSED-DIPOLE SATELLITES Ph.D. Thesis
John Otto Dow 1971 121 p
Avail: Univ. Microfilms Order No. 72-17253

Possible causes of parametric resonance in rotating crossed-dipole satellites and a method for determining the regions of instability for these cases are presented. The satellite which has four equally spaced appendages and a central mass rotates such that the appendages move in the plane of the circular orbit. The motion of the appendages is assumed not to affect the motion of the central mass of the satellite. With these conditions each appendage can be treated independently as a cantilever beam element. The three partial differential equations describing the motion of the appendages in the two orthogonal lateral directions and in the axial direction are derived using energy methods. The stiffness characteristics of the appendages in the lateral directions are included by treating the appendages as Euler-Bernoulli beams. Dissert. Abstr.

N73-16869 Cincinnati Univ., Ohio.
LIAPUNOV STABILITY ANALYSIS OF FLEXIBLE SATELLITES Ph.D. Thesis
Robert Arnold Calico, Jr. 1971 97 p
Avail: Univ. Microfilms Order No. 72-16555

The mathematical formulation associated with the problem of stability of motion of a satellite consisting of a main rigid body and three (or less) pairs of flexible rods is presented. The rods are capable of flexure in two orthogonal directions. Whereas the rotational motion of the body is described by generalized coordinates depending on time alone, the elastic displacements of the rods depend both on spatial position and time. Assuming no external torques, there exist motion integrals in the form of momentum integrals. These integrals can be regarded as constraint equations relating the system velocities, and used to reduce the number of variables describing the motion. The stability analysis has been carried out by means of an extension of the Liapunov direct method. Dissert. Abstr.

N73-16870 Cincinnati Univ., Ohio.
DYNAMIC CHARACTERISTICS OF A VARIABLE MASS FLEXIBLE MISSILE Ph.D. Thesis
John Bankovskis 1971 139 p
Avail: Univ. Microfilms Order No. 72-16553

A general formulation of the dynamical problems associated with powered flight of a two-stage flexible, variable-mass missile with internal flow, discrete masses, and aerodynamic forces is presented. The formulation comprises six ordinary differential equations for the rigid body motion, 3n ordinary differential equations for the n discrete masses and three partial differential equations with the appropriate boundary conditions for the elastic motion. This set of equations is modified to represent a single stage flexible, variable-mass missile with internal flow and aerodynamic forces. The rigid-body motion consists then of three translations and three rotations, whereas the elastic motion is defined by one longitudinal and two flexural displacements, the latter about two orthogonal transverse axes. Dissert. Abstr.

N73-16871 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DESIGN OF A DIGITAL ADAPTIVE CONTROL SYSTEM FOR ATMOSPHERIC REENTRY VEHICLES Ph.D. Thesis
Jose Luis Picon Jimenez 1971 93 p
Avail: Univ. Microfilms Order No. 72-12506

The flying qualities of atmospheric reentry vehicles are unsatisfactory in some portions of their entry trajectories. An adaptive control system has been designed which is capable of modifying the vehicle's characteristics to provide desired flying qualities throughout the entire range of flying conditions. This adaptive control system consists of a finite-memory identifier which determines the vehicle's unknown parameters, and a gain computer which provides suitable feedback gains to satisfy flying

quality requirements. The adaptive control system is demonstrated in a real-time simulation of the longitudinal dynamics of a reentry vehicle with highly nonlinear dynamics and many unknown parameters. Dissert. Abstr.

N73-16872*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
PAYLOAD ANALYSIS FOR SPACE SHUTTLE APPLICATIONS (STUDY 2.2). VOLUME 4: EXECUTIVE SUMMARY Final Report, 1 Oct. 1971 - 31 Aug. 1972
15 Oct. 1972 25 p refs
(Contract NASw-2031)
(NASA-CR-130025; ATR-73(7312)-1-Vol-4) Avail: NTIS HC $3.25 CSCL 22B

The obriter/payload interface area was examined with respect to integrating the payload to the shuttle/tug. Shuttle payload guidelines were developed from NASA study efforts in aerospace design, cost, and operation analyses. Solar observation in a shuttle sortie mode was also studied. E.H.W.

N73-16873*# M&S Computing, Inc., Huntsville, Ala.
MULTI-PROCESSING SYSTEM STUDY Final Report
28 Nov. 1972 60 p refs
(Contract NAS8-27359)
(NASA-CR-124026; Rept-72-0037) Avail: NTIS HC $5.00 CSCL 22B

The results are summarized of a multiprocessor systems design review. The systems were reviewed against use in a space station environment. The proposed designs were evaluated from a systems viewpoint in general and from the systems software in particular. The recommendations resulting from this evaluation are anticipated to be considered for the design of a multiprocessing system built around a SUMC. Two multiprocessing system designs were reviewed. The designs reviewed were highly functional and many questions could not be answered. However, several major issues were uncovered which could be evaluated to some detail, and which could greatly impact the SUMC-MP design. The major issues relevant to a multiprocessing system design revolve around the following functions: (1) Storage Management, (2) Processor Management, (3) Intermodule Communication, (4) Memory Access Interference, (5) System Efficiency, and (6) System Recovery/Reliability. Author

N73-16874*# SCI Systems, Inc., Huntsville, Ala.
A STUDY OF MULTIPLEX DATA BUS TECHNIQUES FOR THE SPACE SHUTTLE Final Summary Report
R. J. Kearney and M. A. Kalange Nov. 1972 436 p refs
(Contract NAS8-26378)
(NASA-CR-124030; Rept-2635-M15) Avail: NTIS HC $24.00 CSCL 22B

A comprehensive technology base for the design of a multiplexed data bus subsystem is provided. Extensive analyses, both analytical and empirical, were performed. Subjects covered are classified under the following headings: requirements identification and analysis; transmission media studies; signal design and detection studies; synchronization, timing, and control studies; user-subsystem interface studies; operational reliability analyses; design of candidate data bus configurations; and evaluation of candidate data bus designs. Author

N73-16875*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPERIMENTAL EVALUATION OF THE SKYLAB ORBITAL WORKSHOP VENTILATION SYSTEM CONCEPT
Steve L. Allums, Leon J. Hastings, and James T. Ralston 14 Mar. 1972 265 p refs
(NASA-TM-X-64700) Avail: NTIS HC $15.25 CSCL 22B

Extensive testing was conducted to evaluate the Orbital Workshop ventilation concept. Component tests were utilized to determine the relationship between operating characteristics at 1 and 0.34 atm. System tests were conducted at 1 atm within the Orbital Workshop full-scale mockup to assess delivered volumetric flow rate and compartment air velocities. Component tests with the Anemostat circular diffusers (plenum- and duct-mounted) demonstrated that the diffuser produced essentially equivalent airflow patterns and velocities in 1- and 0.34-atm environments. The tests also showed that the pressure drop across the diffuser could be scaled from 1 to 0.34 atm using the atmosphere pressure ratio. Fan tests indicated that the performance of a multiple, parallel-mounted fan cluster could be predicted by summing the single-fan flow rates at a given delta P. Author

N73-16876*# Modern Systems Analysis, Inc., Ann Arbor, Mich.
NEAR-EARTH ORBITAL GUIDANCE AND REMOTE SENSING Final Report
William F. Powers Dec. 1972 32 p refs
(Contract NAS9-12319)
(NASA-CR-128713; Rept-9-12319-F) Avail: NTIS HC $3.75 CSCL 22B

The curriculum of a short course in remote sensing and parameter optimization is presented. The subjects discussed are: (1) basics of remote sensing and the user community, (2) multivariant spectral analysis, (3) advanced mathematics and physics of remote sensing, (4) the atmospheric environment, (5) imaging sensing, and (6)nonimaging sensing. Mathematical models of optimization techniques are developed. Author

N73-16877# Ball Bros. Research Corp., Boulder, Colo.
ATTITUDE DYNAMICS OF A NEARLY-SPHERICAL DUAL SPIN SATELLITE AND ORBITAL RESULTS FOR OSO-7
T. M. Spencer 9 Jan. 1973 25 p refs Backup document for AIAA Synoptic scheduled for publication in the Journal of Spacecraft and Rockets in May 1973
Avail: NTIS HC $3.25 CSCL 22B

The OSO-7 exceeded its attitude control requirements with residual spin-axis coning of about 3 arc minutes and pointed instrument jitter of only 1 arc second. Mass properties were unusually critical because OSO-7 is an inertially near-spherical dual-spin satellite. The effects on spin axis coning of body asymmetries, cross-spin gimbal parameter, and the pendulous nutation damper are described. The novel OSO-7 launch sequence which permitted a dramatic recovery after the launch vehicle tumbled before separation is also described. The energy-sink stability condition for dual-spin satellites is generalized to include time varying energy rate weighting factors. This generalized condition is used to show that a satellite with despun asymmetric platform is stable, in spite of energy dissipation on its symmetric rotor, if the rotor spin moment of inertia is larger than the geometric mean of the overall transverse moments of inertia. Author

N73-16878*# General Electric Co., Houston, Tex. Apollo and Ground Systems.
CREW INTERFACE SPECIFICATIONS PREPARATION FOR IN-FLIGHT MAINTENANCE AND STOWAGE FUNCTIONS Final Report
F. W. Parker and B. E. Carlton 9 Nov. 1972 284 p refs
(Contract NAS9-12249)
(NASA-CR-128685) Avail: NTIS HC $16.25 CSCL 22B

The findings and data products developed during the Phase 2 crew interface specification study are presented. Five new NASA general specifications were prepared: operations location coding system for crew interfaces; loose equipment and stowage management requirements; loose equipment and stowage data base information requirements; spacecraft loose equipment stowage drawing requirements; and inflight stowage management data requirements. Additional data was developed defining inflight maintenance processes and related data concepts for inflight troubleshooting, remove/repair/replace and scheduled maintenance activities. The process of maintenance task and equipment definition during spacecraft design and development was also defined and related data concepts were identified for futher development into formal NASA specifications during future follow-on study phases of the contract. Author

N73-16879*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SKYLAB 2 FACILITIES AND ENVIRONMENTAL MEASUREMENTS PROGRAM
Oct. 1972 63 p
(NASA-TM-X-68916; GP-991) Avail: NTIS HC $5.25 CSCL 22B

A list of the facilities and environmental measurements to be monitored in support of the Skylab 2 vehicle is presented. The data include measurement identification number, description, transducer operating range, recorder type, and drawings illustrating measurement location. Author

N73-16880*# Radio Corp. of America, Princeton, N.J. Defense Electronic Products.
ITOS METEOROLOGICAL SATELLITE SYSTEM: TIROS M SPACECRAFT (ITOS 1), VOLUME 1 Final Engineering Report
23 Apr. 1970 510 p 3 Vol.
(Contract NAS5-10306)
(NASA-CR-130163; AED-R-3318F-Vol-1) Avail: NTIS HC $27.50 CSCL 22B

The ITOS system and mission are described along with the design of the TIROS M spacecraft, and the ITOS ground complex. The command subsystems, and the primary environmental sensor subsystem are discussed. F.O.S.

N73-16881*# Radio Corp. of America, Princeton, N.J. Defense Electronic Products.
ITOS METEOROLOGICAL SATELLITE SYSTEM: TIROS M SPACECRAFT (ITOS 1), VOLUME 2 Final Engineering Report
23 Apr. 1970 419 p 3 Vol.
(Contract NAS5-10306)
(NASA-CR-130164; AED-R-3318F-Vol-2) Avail: NTIS HC $23.00 CSCL 22B

The secondary sensors subsystem, and the communications subsystem are described along with the vehicle dynamics subsystem, and the power supply subsystem. F.O.S.

N73-16882*# Radio Corp. of America, Princeton, N.J. Defense Electronic Products.
ITOS METEOROLOGICAL SATELLITE SYSTEM: TIROS M SPACECRAFT (ITOS 1), VOLUME 3 Final Engineering Report
23 Apr. 1970 552 p 3 Vol.
(Contract NAS5-10306)
(NASA-CR-130165; AED-R-3318F-Vol-3) Avail: NTIS HC $29.75 CSCL 22B

The test programs for TIROS M are reported. Test histories reported include: mechanical test models, thermal test models, antenna test models, ETM test program, and flight acceptance. Prelaunch activities and ground station equipment are described. F.O.S.

N73-16883# Sandia Labs., Albuquerque, N.Mex.
FLIGHT TEST EVALUATION OF A FLUIDICALLY ACTUATED MONOPROPELLANT HYDRAZINE ROLL CONTROL SYSTEM (ABSTRACT)
A. E. Hodapp, Jr. and R. C. Beckmann 1972 32 p refs Sponsored by AEC
(SC-DC-722244-A) Avail: NTIS

A fluidically actuated monopropellant hydrazine roll control system was developed for evaluation. This system was developed to obtain a method for eliminating the roll rate anomalies that are often observed during the flights of slender ballistic reentry vehicles. The control system under evaluation maintains roll control through the use of four laterally directed hydrazine-fueled thrusters or rocket engines that are located in a plane parallel to the base plane of the reentry vehicle. These thrusters are fired in pairs to provide either positive or negative roll torques (couples). The control system has desirable features in that (1) it utilizes fluidic logic and is pneumatically actuated, requiring no electrical power except for initialization; (2) it is designed such that its operation is insensitive to all body motion variables except roll rate; (3) it does not depend on aerodynamic forces and/or moments to provide a control torque; and (4) the effects of its operation on flow around a vehicle can be confined to the base flow region. Author

N73-16884# Sandia Labs., Albuquerque, N.Mex.
EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF NOZZLE ORIENTATION AND LOCATION ON THE ROLL CONTROL AND BASE PRESSURE FOR HYPERSONIC REENTRY VEHICLE
B. W. Marshall and A. A. Trujillo 1972 15 p refs Sponsored by AEC
(SC-DC-721187-A) Avail: NTIS

The requirement for a system to control the roll rate of reentry vehicles during certain portions of their trajectories has been established. Among the concepts proposed for this control are the use of either aerodynamic surfaces such as fins or thrusting devices such as small reaction jet nozzles mounted at the periphery of the vehicle base. A system which operates on the reaction jet concept has been designed using hydrazine as the fuel. The chemical decomposition of hydrazine generates a high pressure, high temperature gas mixture which is directed through small supersonic nozzles to produce torque on the vehicle. This type of roll control system is generally mounted on the vehicle base plane. For certain applications it may be desirable to place the nozzles forward of the base plane which results in their being shrouded within the vehicle base cavity. Movement of the nozzles forward into the vehicle base cavity would have the effect of increasing the vehicle's static stability margin through a forward movement of the vehicle's center of gravity with no change occurring in the center of pressure location.
Author (NSA)

N73-16885# European Space Vehicle Launcher Development Organization, Paris (France).
EUROPA 3: PREPARATORY PHASE, VOLUME 1, PART 1 Final Report
15 Mar. 1972 240 p
Avail: NTIS HC $14.50

The basic principles of the Europa 3 rocket and its management procedures are outlined, as well as the general technical requirements for system development. Stage requirements for the first stage, Drakkar, a UDMH dinitrogen tetroxide propelled Viking engine, are dealt with. ESRO

N73-16886# European Space Vehicle Launcher Development Organization, Paris (France).
EUROPA 3: PREPARATORY PHASE, VOLUME 1, PART 2 Final Report
15 Mar. 1972 190 p
Avail: NTIS HC $11.50

The preliminary requirements to be met during the design and testing of the second stage of Europa 3 launch vehicle are given. Its propulsion system will be a topping cycle high pressure, hydrogen-oxygen rocket engine. ESRO

N73-16887# European Space Vehicle Launcher Development Organization, Paris (France).
EUROPA 3: PREPARATORY PHASE, VOLUME 2, PART 1 Final Report
15 Mar. 1972 274 p
Avail: NTIS HC $15.75

The engineering work during the predevelopment phase of Europa 3 is described. Design solutions, technologies developed, results of overall integration studies of the vehicle, the electrical mock-up, and the dynamic model are presented. The first stage, Drakkar and its rocket engine, Viking, as well as the second stage structure are described. ESRO

N73-16888# European Space Vehicle Launcher Development Organization, Paris (France).
EUROPA 3: PREPARATORY PHASE, VOLUME 2, PART 2 Final Report
15 Mar. 1972 216 p
Avail: NTIS HC $13.00

The engineering work and technologies developed during the preparatory phase of Europa 3 outlined. The second stage and its propulsion system are described, as well as other systems and subsystems, such as the vehicle bay and related onboard and ground equipment, the fairings, the interstage structure, and the separation system. Launching site and ground support equipment requirements are summarized. ESRO

N73-16889# European Space Vehicle Launcher Development Organization, Paris (France).
EUROPA 3: PREPARATORY PHASE, VOLUME 3 Final Report
15 Mar. 1972 91 p 3 Vol.
Avail: NTIS HC $6.75

Time and cost planning information resulting from the Europa 3 project definition phase is presented. After preparation of the development phase work breakdown structure and the master schedule work statements, detailed plans were worked out for all program elements and used as a basis for cost estimation. ESRO

N73-16890# Societe Europeenne d'Etude et d'Integration de Systems Spatiaux, Courbevoie (France).
INTRODUCTION TO A STUDY OF THE PRINCIPLES OF LAUNCH VEHICLE STRUCTURAL DESIGN [INTRODUCTION A L'ETUDE DES CRITERES DE DIMENSIONNEMENT DES STRUCTURES DE LANCEURS]
J. Barbe 26 Mar. 1971 28 p refs In FRENCH
(NT-D3-71.040) Avail: NTIS HC $3.50

The criteria on which structural design of launch vehicles is based, which result from the compatibility of structural stability and environmental loads applied to the structure, are examined with regard to structural reliability. Safety factors are defined statistically and it is concluded that they are one of the criteria to be considered in design, though not a guarantee of safety. It is recommended that technical specifications be added to aerospace contracts with industry, in order to offset the present empiricism of design criteria and the lack of official standards.
ESRO

N73-16891# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
OPTIMAL AERODYNAMIC AND THRUST MAGNITUDE CONTROL OF MANEUVERING ROCKETS Final Report
N. X. Vinh, W. F. Powers, and C. J. Shieh Sep. 1972 81 p refs
(Grant AF-AFOSR-2129-71; AF Proj. 9769)
(AD-751281; AFOSR-72-2038TR; Rept-010197-F) Avail: NTIS CSCL 16/4

The report presents the results of a study to evaluate thrust magnitude control in Air Force missions. In this study modern control theory was applied to determine the time history of the thrust profile to achieve optimal maneuvers of aerospace lifting vehicles. Following formulation of a mathematical model with a very general propulsion system, optimal control laws for the thrust direction and magnitude were obtained. It was shown that coast, boost, and sustaining thrust could all be optimal. For the particular case of the sustaining flight it was shown that the position vector, the velocity vector, and the mass of the rocket vehicle must satisfy a certain explicitly obtained relationship, and that the variable thrust magnitude depends strongly on the aerodynamic characteristics of the vehicle and the optimal trajectory flown.
Author (GRA)

N73-16892# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LAUNCHING EQUIPMENT FOR GUIDED MISSILES
Miro Boras and Stevan Roglic 24 Aug. 1972 26 p Transl. into ENGLISH from Vazouhoplovni Glas. (Yugoslavia), v. 17, no. 2, 1970 p 199-211
(AD-751089; FTD-HC-23-0635-72) Avail: NTIS CSCL 17/7

The guided missile guidance system is designed for guidance after the missile takeoff and takes over its function during the flight in order to ensure a direct hit on the target, or an effective lethal explosion in the targets immediate vicinity. The guidance system must fulfill this task without regard to any natural or man made obstacles, countermeasures, and actions which might normally be encountered. The document discusses a large number of guided missile guidance systems.
GRA

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue, thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-16893 Engineering Sciences Data Unit, London (England).
[STANDARDIZED STRESS-STRAIN CURVES]
Jul. 1972 2 p Reprinted
(ESDU-00.01.00; ESDU-00.02.00) Copyright. Avail: Issuing Activity

Information is given concerning the use of published reference data on standardized stress-strain curves of aluminum alloy and certain other materials.
D.L.G.

N73-16894 Engineering Sciences Data Unit, London (England).
[CALCULATION PROCEDURE FOR ESTIMATING STRESS RANGE IN TITANIUM AND HIGH STRENGTH STEEL PANELS]
[1972] 4 p refs
(ESDU-72005-Amend-A) Copyright. Avail: Issuing Activity

Procedures for estimating stresses in titanium and high strength steel panels are presented. Conversion of spectrum sound pressure level to the spectral density of acoustic pressure is described. A comparison of estimated and measured stresses in flat and curved plates is developed. Mathematical models to amplify the text are included.
Author

N73-16895 Engineering Sciences Data Unit, London (England).
[FATIGUE STRENGTH, ENDURANCE, STRESS, AND STRUCTURAL RESPONSES TO ACOUSTIC EXCITATION]
Oct. 1972 2 p refs
(ESDU-72001-Amend-A) Copyright. Avail: Issuing Activity

Development of expression for response of structure to acoustic excitation is described. Effects of modes of vibration of the structure, natural frequencies and damping, and noise field characteristics are considered. Fatigue strength and endurance of panel are analyzed with respect to stress concentration and fretting.
Author

N73-16896# Advisory Group for Aerospace Research and Development, Paris (France).
SYMPOSIUM ON RANDOM LOAD FATIGUE
Oct. 1972 237 p refs Symp. held at 34th meeting of the AGARD Struct. and Mater. Panel, Lyngby, Denmark, 13 Apr. 1972; sponsored by Struct. and Mater. Panel
(AGARD-CP-118) Avail: NTIS HC $14.00

Physical aspects of fatigue damage accumulation and the significance of theories for the calculation of fatigue damage accumulation are reviewed. Influence of test frequencies on crack propagation rates, measurements of residual stresses in notched specimens, etc. are reported. For individual titles, see N73-16897 through N73-16904.

N73-16897 Societe Nationale Industrielle Aerospatiale, Paris (France).
A SHORT SURVEY ON POSSIBILITIES OF FATIGUE LIFE ASSESSMENT OF AIRCRAFT STRUCTURES BASED ON RANDOM OR PROGRAMMED FATIGUE TESTS
W. Barrois *In* AGARD Symp. on Random Load Fatigue Oct. 1972 21 p refs (For availability see N73-16896 07-32)

After considering designers' needs and detailing the various physical parameters that are significant in the fatigue behavior of specimens and structures, several types of fatigue tests are reviewed. Prediction methods of structure fatigue life from fatigue tests of components, assemblies and structures undergoing constant amplitude loadings are surveyed. After considering fatigue tests under programmed loadings, the case of random loadings is briefly discussed. It is concluded that describing random loadings by their root mean squares is not sufficient to predict the fatigue lives of structures even when the shape of the load power spectrum is known, except in cases of comparative prediction where the only change is the general intensity of the spectrum. The possibility of test acceleration by increasing the general loading intensity is considered.
Author

N73-16898 Royal Aircraft Establishment, Farnborough (England). Structures Dept.
SOME EFFECTS OF CHANGE IN SPECTRUM SEVERITY AND SPECTRUM SHAPE ON FATIGUE BEHAVIOUR UNDER RANDOM LOADING
W. T. Kirkby *In* AGARD Symp. on Random Load Fatigue Oct. 1972 19 p refs (For availability see N73-16896 07-32)

The problem of reassessing the fatigue life of an aircraft structure is considered, when it is found that the spectrum of loads experienced in service differs from the load spectrum applied in test. Results obtained during fatigue tests on structural elements under random load spectra are used to illustrate some of the important considerations involved. It is shown that the use of an improved method of life prediction will generally lead to improved accuracy in reassessing life.
Author

N73-16899 National Aerospace Lab., Amsterdam (Netherlands).
THE ACCUMULATION OF FATIGUE DAMAGE IN AIRCRAFT MATERIALS AND STRUCTURES
J. Schijve *In* AGARD Symp. on Random Load Fatigue Oct. 1972 120 p refs (For availability see N73-16896 07-32)

Physical aspects of fatigue damage accumulation are discussed, including interaction and sequence effects. Empirical trends observed in variable-amplitude tests are summarized including the effects of a high preload, periodical high loads, ground-to-air cycles, and the variables pertaining to program loading, random loading, and flight simulation loading. This also includes results from full scale fatigue test series. Various theories on fatigue damage accumulation are recapitulated. The significance of these theories for explaining empirical trends as well as for estimating fatigue properties as a design problem is evaluated. Author

N73-16900 National Aerospace Lab., Amsterdam (Netherlands).
EFFECTS OF TEST FREQUENCY ON FATIGUE CRACK PROPAGATION UNDER FLIGHT-SIMULATION LOADING
J. Schijve *In* AGARD Symp. on Random Load Fatigue Oct. 1972 17 p refs (For availability see N73-16896 07-32)

Fatigue crack propagation in 2024-T3 and 7075-T6 sheet material was studied at three test frequencies, viz. 10, 1, and 0.1 cycles per second. The flight simulation loading was based on a gust spectrum. The design stress level was adopted as a second variable. Differences between the crack propagation rates at the three test frequencies were small and unsystematic. The propagation was much slower than predicted from constant amplitude test data. Moreover, the macro-cracking behavior appeared to be different. Author

N73-16901 Air Force Systems Command, Wright-Patterson AFB, Ohio.
CORRELATION BETWEEN LABORATORY TESTS AND SERVICE EXPERIENCE
W. B. Miller and Holland B. Lowndes *In* AGARD Symp. on Random Load Fatigue Oct. 1972 16 p refs (For availability see N73-16896 07-32)

Direct comparisons are made between full scale fatigue test failures and actual service failures for several military aircraft. The correlations are discussed in relation to the basic fatigue test procedures and spectra used. Some methods used to force correlation where apparent correlation is lacking are discussed. The improvements in fatigue testing evolved over the past 25 years are summarized. Author

N73-16902 Technical Univ. of Denmark, Lyngby. Dept. of Solid Mechanics.
ON RESIDUAL STRESSES DURING RANDOM LOAD FATIGUE
Find Rotvel *In* AGARD Symp. on Random Load Fatigue Oct. 1972 14 p refs (For availability see N73-16896 07-32)

Data are presented from random fatigue tests on normalized carbon steel with 0.7% carbon. In notched specimens, a preload beyond the yield stress induced residual stresses around the notch. The residual stresses were measured with an X-ray measuring technique at intervals during the fatigue loading. Results from broadband and narrowband stochastic loading tests are compared with constant amplitude sinusoidal tests. Author

N73-16903 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
THE FATIGUE LIFE UNDER THREE DIFFERENT LOAD SPECTRA - TESTS AND CALCULATIONS
Walter Schuetz *In* AGARD Symp. on Random Load Fatigue Oct. 1972 10 p refs (For availability see N73-16896 07-32)

One of the more important problems in the fatigue life prediction of military airplanes is caused by the difference between the load spectrum used in the full scale fatigue test and the load spectrum in service. Complex flight-by-flight tests with two types of notched specimens and a bolted joint simulating a skin fitting joint were carried out under three different load spectra occurring in service of a German military airplane. It is shown that Miner's rule can be used as a transfer function (relative Miner rule) to calculate the lives with high accuracy for the notched specimens and with less accuracy for the bolted specimens. Author

N73-16904 Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
A RELATION BETWEEN MEASURED CENTER OF GRAVITY VERTICAL ACCELERATIONS AND THE LOADS AT THE T-TAIL OF A MILITARY AIRPLANE c02
Otto Buxbaum *In* AGARD Symp. on Random Load Fatigue Oct. 1972 16 p refs (For availability see N73-16896 07-32)

An engineering solution is presented for correlating two different random loads - time histories, based on measurements of C.G. vertical accelerations and loads at the tailplane of an aircraft. The choice of instrumentation for a fleet airplane is described, and the measurements of operational loads are related to C.G. acceleration countings. Author

N73-16905*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF AN AEROELASTIC MODEL TECHNIQUE FOR PREDICTING AIRPLANE BUFFET LOADS
Perry W. Hanson Washington Feb. 1973 62 p refs (NASA-TN-D-7066; L-8460) Avail: NTIS HC $3.00 CSCL 01C

A wind-tunnel technique which makes use of a dynamically scaled aeroelastic model to predict full-scale airplane buffet loads during buffet boundary penetration is evaluated. A 1/8-scale flutter model of a fighter airplane with remotely controllable variable-sweep wings and trimming surfaces was used for the evaluation. The model was flown on a cable-mount system which permitted high lift forces comparable to those in maneuvering flight. Bending moments and accelerations due to buffet were measured on the flutter model and compared with those measured on the full-scale airplane in an independent flight buffet research study. It is concluded that the technique can provide valuable information on airplane buffet load characteristics not available from any other source except flight test. Author

N73-16906# Lockheed Missiles and Space Co., Palo Alto, Calif.
SHELL STABILITY UNDER A DYNAMIC LOAD
V. M. Darevskii [1972] 15 p refs Transl. into ENGLISH from the book "Problemy Mekhaniki Tverdogo Deformirovannogo Tela" Leningrad, Sudostroenie, 1970 p 149-160
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A procedure for determining shell stability under a dynamic load is presented. The development of a stability criterion which forms the basis for the structural analysis is discussed. Mathematical solutions are included for the following cases: (1) uniformly loaded medium length cylindrical shell, (2) cylindrical shell under an instantaneously applied uniform pressure, (3) linearly increasing pressure which drops instantaneously after reaching given value, (4) pressure varying according to piecewise-linear law, and (5) pressure as a periodic function of time. Author

N73-16907*# Structures Research Associates, Laguna Beach, Calif.
THE EFFECT OF ANGLE OF ATTACK ON THE BUCKLING OF MARS ENTRY AEROSHELLS
Gerald A. Cohen Washington NASA Feb. 1973 21 p refs (Contract NAS1-10091)
(NASA-CR-2087) Avail: NTIS HC $3.00 CSCL 20K

The buckling modes of four optimized Mars entry aeroshell configurations at angle-of-attack loadings have been calculated. The analysis is based on experimental pressure distributions and was performed with the aid of a buckling digital computer program which treats general asymmetric linearized prebuckling states of branched shells of revolution. Only zero and first harmonic pressure components are treated, these bein - constructed from windward and leeward meridian pressure data at a mach number of 4.63. The results showed a rather small effect of the unsymmetrical pressure component on buckling for angles of attack up to 15 deg. Comparison of the results for the 120 deg cones to previous results indicates that the common procedure of basing the design on a symmetrized pressure distribution of the windward meridian is a conservative approach. Author

N73-16908*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MIXED FINITE-DIFFERENCE SCHEME FOR FREE VIBRATION ANALYSIS OF NONCIRCULAR CYLINDERS

Ahmed K. Noor and Wendell B. Stephens Washington Feb. 1973 30 p refs
(NASA-TN-D-7107; E-8288) Avail: NTIS HC $3.00 CSCL 20K

A mixed finite-difference scheme is presented for the free-vibration analysis of simply supported closed noncircular cylindrical shells. The problem is formulated in terms of eight first-order differential equations in the circumferential coordinate which possess a symmetric coefficient matrix and are free of the derivatives of the elastic and geometric characteristics of the shell. In the finite-difference discretization, two interlacing grids are used for the different fundamental unknowns in such a way as to avoid averaging in the difference-quotient expressions used for the first derivative. The resulting finite-difference equations are symmetric. The inverse-power method is used for obtaining the eigenvalues and eigenvectors. Author

N73-16909*# Vought Aeronautics, Dallas, Tex.
FATIGUE EVALUATION OF COMPOSITE-REINFORCED INTEGRALLY STIFFENED METAL PANELS: SUMMARY
C. E. Dumesnil Washington NASA Feb. 1973 32 p refs
(Contract NAS1-10871)
(NASA-CR-2136) Avail: NTIS HC $3.00 CSCL 20K

The fatigue and fail-safe behavior of composite-reinforced, integrally stiffened metal panels was investigated. Test results consisting of conventional fatigue lives, fatigue-crack propagation rates, and residual static strength are presented and discussed. Author

N73-16910*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
TWO BONDED HALF PLANES WITH A CRACK GOING THROUGH THE INTERFACE
F. Erdogan and V. Biricikoglu Washington NASA Feb. 1973 45 p refs
(Grant NGR-39-007-011)
(NASA-CR-2181) Avail: NTIS HC $3.00 CSCL 20K

The plane problem of two bonded elastic half planes containing a finite crack perpendicular to and going through the interface is considered. The problem is formulated as a system of singular integral equations with generalized Cauchy kernels. Even though the system has three irregular points, it is shown that the unknown functions are algebraically related at the irregular point on the interface and the integral equations can be solved by a method developed previously. The system of integral equations is shown to yield the same characteristic equation as that for two bonded quarter planes in the general case of the through crack, and the characteristic equation for a crack tip terminating at the interface in the special case. The numerical results given in the paper include the stress intensity factors at the crack tips, the normal and shear components of the stress intensity factors at the singular point on the interface, and the crack surface displacements. Author

N73-16911# Pittsburgh Univ., Pa. Dept. of Mechanical Engineering.
A TREATISE ON THE STABILITY OF ELASTIC SYSTEMS Final Report
S. J. Britvec Aug. 1972 207 p refs
(Grant NSF GK-2879)
(PB-212011) Avail: NTIS HC $3.00 CSCL 20K

The relationship between external loads and states of deformation in light elastic structures is analyzed. The change in physical state in a static conservative system is studied to determine where in the critical range of static loading the system may be set into motion and to ascertain if collapse is imminent. Sensitivity to small geometric imperfections in three dimensional light structures is verified. The energy and equalibrium approaches of analysis and their criteria are derived. The exact theory covering the analysis of structural plane and space framework as a special case permits reduction of all cases of plane buckling of prismatic members to five basic relations. Author (GRA)

N73-16912# University of Southern Calif., Los Angeles. Dept. of Civil Engineering.
LIMIT PRESSURES OF CIRCULAR CYLINDRICAL SHELLS SUBJECT TO RIGID DISPLACEMENT CONSTRAINTS Final Report
Ho Hwa-shan Aug. 1972 44 p refs
(Grant NSF GK-27828)
(PB-212638; USCCE-004) Avail: NTIS HC $3.00 CSCL 20K

The exact limit pressure is examined for a circular cylindrical shell rigidly supported at both ends. The Tresca yield criterion is assumed, with shear deformation neglected. Exact velocity and stress field equations are derived. It is found that the limit pressure is reached only asymptotically. In other words, plastic rupture occurs only if a small central ring force is applied, if the velocity field is to remain finite. As expected, result shows an inverse correlation between the shell length and the yield pressure. Calculations are obtained by introducing a small perturbing outward central ring force. Author (GRA)

N73-16913# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDIES ON THE THEORY OF PLATES AND SHIELDS, SELECTED ARTICLES
12 Aug. 1972 144 p refs Transl. into ENGLISH from Issled. po Teorii Plastin i Obolochek (USSR), no. 4, 1966 135 p
(AD-751502; FTD-MT-24-106-72) Avail: NTIS CSCL 20/11

Selected articles are presented relative to the response of structurally loaded shells. GRA

N73-16914# Rensselaer Polytechnic Inst., Troy, N.Y. Mechanics Div.
NONLINEAR ELECTROELASTIC EQUATIONS FOR SMALL FIELDS SUPERPOSED ON A BIAS
J. C. Baumhauer and H. F. Tiersten Oct. 1972 56 p refs
(Contract N00014-67-A-0117-0007)
(AD-751624; TR-7) Avail: NTIS CSCL 20/12

The nonlinear differential equations and boundary conditions in small field variables, for small fields superposed on large static biasing states, are obtained from general rotationally invariant nonlinear electroelastic equations derived previously. The small field equations are directly applicable in the consistent description of parametric effects in high coupling piezoelectric materials in terms of the fundamental material parameters. The application of the equations to homogeneously polarized ferroelectrics reveals that in the linear limit the electroelastic equations are identical with the equations of linear piezoelectricity for the symmetry of the polarized state. The influence of a thickness directed homogeneous biasing electric field on the thickness vibrations of a piezoelectric plate, to second order in the biasing field, has been determined. Author (GRA)

N73-16915# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
INERTIAL GUIDE TEST PAD STUDY Final Report, 1 Jun. 1971 - 31 May 1972
Robert Burridge Jun. 1972 61 p refs
(Contract F19628-71-C-0176; AF Proj. ILIR)
(AD-751332; AFCRL-72-0379) Avail: NTIS CSCL 20/11

The report deals with the problem of finding the vibration of a foundation block (test pad) imbedded in, or resting on, an elastic substratum, when seismic waves traveling in the elastic substrate impinge upon the foundation block. Chapter 1 deals with the situation where a rigid block is welded to the surface of an elastic half-space. The problem is set up mathematically as a system of integro-differential equations in one space dimension and time. A numerical scheme is set up to solve the system step-by-step in time for arbitrary, time dependent, incident radiation. In particular the incident field may represent body waves or Rayleigh waves. Computer programs which execute the numerical scheme are listed and their function described in Appendices to Chapter 1. In Chapter 2 an analytical treatment is given for the problem where incident SH waves impinge upon a rigid strip. Asymptotic formulae valid when the width of the strip is small compared with a wavelength are given. Author (GRA)

N73-16916# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
COLLAPSE ANALYSIS FOR SHELLS OF GENERAL SHAPE. VOLUME 1: ANALYSIS Final Report, Apr. 1969 - Jan. 1972
B. O. Almroth, F. A. Brogan, and M. B. Marlowe Wright-Patterson AFB, Ohio AFFDL Aug. 1972 95 p refs

(Contract F33615-69-C-1523; AF Proj. 1467)
(AD-751702; AFFDL-TR-71-8-Vol-1) Avail: NTIS CSCL 20/11

The report presents a theory for nonlinear collapse analysis of shells with general shape. The theory combines energy principals and finite difference methods to obtain a system of nonlinear equations; these are solved by a modified Newton-Raphson technique. For greater economy and flexibility in the analysis a capability is provided for use of variable spacing finite difference grids. Inelastic material behavior, as predicted by the White-Besseling Theory, is incorporated into the analysis. A computer code, STAGS, based on the theory has been written and used to solve a number of sample problems. Results for these problems are presented. Author (GRA)

N73-16917# Army Construction Engineering Research Lab., Champaign, Ill.
FEASIBILITY OF APPLYING FRINGE MULTIPLICATION TECHNIQUES TO STRESS ANALYSIS IN THREE DIMENSIONS Final Technical Report
John H. Hubbard Jul. 1972 23 p refs
(CERL Proj. XY1)
(AD-751172; CERL-TR-S-9) Avail: NTIS CSCL 14/2

The report presents an evaluation of the fringe multiplication technique as an adjunct to the frozen stress approach of three dimensional experimental stress analysis. A model of the intersection of two horseshoe shaped tunnels was constructed and loaded at an elevated temperature. Slices were cut from the model for study. Isochromatic fringe multiplication up to and including 7X was obtained on selected slices. The fringe sharpening technique was demonstrated. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-16918* North American Rockwell Corp., Downey, Calif.
SELF-CYCLING FLUID HEATER Patent
Walter K. Moen, inventor (to NASA) Issued 2 Jan. 1973 9 p Filed 6 Nov. 1970 Supersedes N72-15893 (10 - 06, p 0835) Sponsored by NASA
(NASA-Case-MSC-15567-1; US-Patent-3,708,419; US-Patent-Appl-SN-87551; US-Patent-Class-204-328; US-Patent-Class-204-324; US-Patent-Class-204-325) Avail: US Patent Office CSCL 20M

A self-cycling fluid heater is described which includes a high temperature upstream preheater for elevating the stream temperature. A high intensity jet arc heater heats the preheated fluid stream to ultrahigh reaction temperatures and discharges the stream into an electric resistance tubular heat exchanger. The heat exchanger has variations in wall thickness at measured intervals along its length to control the temperature of the fluid passing through the heat exchanger for desired time intervals to provide the specified chemical reactions desired.
Official Gazette of the U.S. Patent Office

N73-16919 Engineering Sciences Data Unit, London (England).
APPROXIMATE TRANSPORT PROPERTIES OF HIGH TEMPERATURE AIR IN DISSOCIATION EQUILIBRIUM
1972 9 p refs
(ESDU-00.01.07-Amend-A) Copyright. Avail: Issuing Activity

The approximate transport properties of high temperature air in dissociation equilibrium are presented. The data are based on values of viscosity, thermal conductivity, Prandtl number, and the product of viscosity and density as functions of pressure and specific enthalpy for air. Mathematical models are included to amplify the theory. Author

N73-16920 Texas Univ., Austin.
THERMAL RADIATION EFFECTS ON THE FLOW OF GAS IN DUCTS AND THE TRANSIENT MOTION OF INCIDENT AND REFLECTED NORMAL SHOCK WAVES NEAR A RADIATING SURFACE Ph.D. Thesis
William Leslie Hendricks 1971 172 p
Avail: Univ. Microfilms Order No. 72-11353

A theoretical study is made of one-dimensional flow downstream of a source of radiation in constant area ducts and in conical nozzles. In general the study provides a description of radiation-induced wave motion and flow field perturbations in the form of pressure, temperature and velocity as functions of distance and time. For flow in constant area ducts, both steady-state and transient (impulsive) source radiation is considered. Closed form analytical solutions are obtained by assuming small perturbations, using the exponential approximation, and assuming gas emission to be negligible compared to the source emission. These solutions provide the first step for iterative procedures that would yield solutions that account for gas emission and nonlinear effects. For flow in conical nozzles, only steady-state radiation is considered. A nonlinear numerical solution is obtained by using the grey-gas approximation.
Dissert. Abstr.

N73-16921 South Carolina Univ., Columbia.
THE MECHANISM OF CONDENSED PHASE REACTION IN THE COMBUSTION OF DOUBLE BASE SOLID ROCKET PROPELLANTS Ph.D. Thesis
Amarendranath Datta 1971 172 p
Avail: Univ. Microfilms Order No. 72-18148

A physical model of the mechanism of condensed phase reaction in the double-base propellant is presented. It is proposed that condensed phase reaction starts at certain favorable sites provided by interfaces with foreign particles and by voids within the solid. The initial reaction consists of breakage of some of the weakest bonds, such as the O-N bond, of the long-chain molecules of nitroglycerine and nitrocellulose. The resulting gaseous fragments undergo further reactions in bubbles of gas, while still embedded in the condensed matter, thus, releasing heat and generally contributing to the overall burning rate. In order to test this hypothesis, specimens of the propellant containing measured proportions of an inert material (aluminum oxide) in finely powdered form of known particle-sizes were tested for burning rate. Dissert. Abstr.

N73-16922*# IIT Research Inst., Chicago, Ill. Technology Center.
DEVELOPMENT OF SPACE STABLE THERMAL CONTROL COATINGS FOR USE ON LARGE SPACE VEHICLES Triannual Report, 1 May - 31 Aug. 1972
J. E. Gilligan 25 Sep. 1972 73 p
(Contract NAS8-26791; IITRI Proj. C6233)
(NASA-CR-124003; IITRI-C6233-20) Avail: NTIS HC $5.75 CSCL 20M

A reserach project to develop space stable thermal control coatings for large surfaces is discussed. Four major tasks are considered: (1) pigment development, (2) binder development, (3) environmental effects evaluations, anp (4) general coatings investigations. Author

N73-16923# National Aerospace Lab., Tokyo (Japan).
TRANSIENT THERMAL STRESSES OF THE HOLLOW CYLINDER SUBJECTED UNIFORM INNER HEATING
Koichi Egawa and Yukihiko Takenaka May 1972 16 p refs In JAPANESE; ENGLISH summary
(NAL-TR-287) Avail: NTIS HC $3.00

The investigation was undertaken to examine the reliability of high temperature strain gages in experimental thermal strain measurements. A long, thick-walled, hollow cylinder, with uniform inndr heating and an adiabatic outside wall, was used as the test specimen. The cylinder was used because of the simplicity in establishing the analytical boundary conditions in the experiment, and also the simplicity in comparing the experimental thermal strains with the analytical ones. The transient thermal strains in the axial and the circumferential directions on the outer surface of the cylinder were measured by using one strain gage for each direction. These strain gages are known to be able to measure strains up to 315 C. The experimental results obtained correspond closely to the analytical results obtained in the tendencies of change and the magnitude of change. Thus, it can be expected that reliable experimental thermal strains can be measured with high temperature strain gages. Author

N73-16924# Research Inst. of National Defence, Stockholm (Sweden).
THE TEMPERATURE RISE IN A HERMETICALLY SEALED STANDARD SHELTER WITH AND WITHOUT FIRE OUTSIDE
B. Martensson and Ivar Lill Mar. 1971 63 p refs In SWEDISH (FOA-1-A-1527-76) Avail: NTIS HC $5.25

The rise in temperature in a hermetically sealed standard shelter has been calculated. An analysis of sensitivity has been carried out based on the variation of essential factors due to the termperature rise. The calculations were made on the FOAI PDP8 computer. The lifetime in the shelter was about 2 hours in the summer and 24 hours or more, in wintertime. The greatest influences on the lifetime were the number of people in the shelter, the size of the surface area of the concrete shelter and the heat transfer rate. When the shelter roof was exposed to fire the lifetime was reduced to about 1 1/2 hours during summer time and barely 2 hours in the winter, reckoned from starting the fire. The lifetime could be lengthened by increasing air circulation in the shelter and in the case of fire, by outside heat insulation for the shelter roof. Investigations were also made into the use of sand as a heat buffer. With air entering the filter at 200 C, the input air to the shelter increased 5 C after 15 to 20 hours. Author

N73-16925*# Linguistic Systems, Inc., Cambridge, Mass.
THERMODYNAMICS OF THE PYROLYSIS OF HYDROCARBONS IN A NITROGEN PLASMA
S. N. Ganz and Yu. Krasnokutskiy Washington NASA Jan. 1973 14 p refs Transl. into ENGLISH from Khim. Tekhnol. (USSR), no. 19, 1971 p 18-24
(Contract NASw-2482)
(NASA-TT-F-14685) Avail: NTIS HC $3.00 CSCL 20M

The process is investigated of the pyrolysis of hydrocarbons in a nitrogen plasma in order to obtain acetylene and hydrocrabon cyanide. A thermodynamic calculation of the process of converting hydrocarbons in a nitrogen plasma was made. Account is also taken of the secondary reaction products. F.O.S.

N73-16926*# Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF ROTATING, NON-CAPILLARY HEAT PIPES Final Report
P. J. Marto 30 Nov. 1972 67 p refs
(Contract NASA Order W-13007)
(NASA-CR-130373; NPS-59MX72111a) Avail: NTIS HC $5.50 CSCL 20M

An approximate theoretical model is derived for laminar film condensation on the inside of a rotating, truncated cone, and is used to predict the heat transfer performance of rotating, non-capillary heat pipes for a wide variety of parametric conditions. Experimental results are presented for water, ethyl alcohol, and freon-113 in a stainless steel heat pipe rotating to speeds of 2800 rpm. Results show that these devices can be used effectively to transfer large quantities of heat in rotating systems. Predicted results agree to within + or - 20 percent of the experimental data. Dropwise condensation, instead of film condensation, improves heat pipe performance while the presence of non-condensible gases impairs performance. Author

N73-16927*# Bell Aerospace Co., Buffalo, N.Y.
COMOC: THERMAL ANALYSIS VARIANT. USER'S MANUAL Program User's Manual Jun. - Oct. 1972
Alan M. Bauer and A. J. Baker Oct. 1972 61 p ref
(Contract NAS5-11935)
(NASA-CR-130148; Rept-9500-920256) Avail: NTIS HC $5.25 CSCL 20M

The Thermal Analysis Variant of the COMOC (computational continuum mechanics) computer system solves problems involving transient heat conduction and convection in stationary continua spanning arbitrarily irregular two-dimensional and axisymmetric solution domains. COMOC is based upon a finite element solution algorithm for the energy equation, and solves for the transient nodal temperature distribution using a highly stable and automatic explicit integration procedure. COMOC is extensively user-oriented, requires minimal input, and no a priori knowledge concerning the stability character of the differential equation system. It can readily output computed data in user-specified format fields, that geometrically resemble the solution domain discretization (for rapid engineering evaluation). Complete information is provided for applying COMOC to a specific problem. Author

N73-16928*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RATE OF REACTION BETWEEN MOLECULAR HYDROGEN AND MOLECULAR OXYGEN
Richard S. Brokaw Washington Feb. 1973 11 p refs
(NASA-TM-X-2707; E-7195) Avail: NTIS HC $3.00 CSCL 20M

The shock tube data of Jachimowski and Houghton were rigorously analyzed to obtain rate constants for the candidate initiation reactions H2 + O2 yields H + HO2, H2 + O2 yields H2O + O, and H2 + O2 yields OH + OH. Reaction (01) is probably not the initiation process because the activation energy obtained is less than the endothermicity and because the derived rates greatly exceed values inferred in the literature from the reverse of reaction (01). Reactions (02) and (03) remain as possibilities, with reaction (02) slightly favored on the basis of steric and statistical considerations. The solution of the differential equations is presented in detail to show how the kinetics of other ignition systems may be solved. Author

N73-16929*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-PRESSURE COMBUSTOR EXHAUST EMISSIONS WITH IMPROVED AIR-ATOMIZING AND CONVENTIONAL PRESSURE-ATOMIZING FUEL NOZZLES
Robert D. Ingebo and Carl T. Norgren Washington Feb. 1973 24 p refs
(NASA-TN-D-7154; E-7148) Avail: NTIS HC $3.00 CSCL 21B

A high-pressure combustor segment 0.456 meter (18 in.) long with a maximum cross section of 0.153 by 0.305 meter (6 by 12 in.) was tested with specially designed air-atomizing and conventional pressure-atomizing fuel nozzles at inlet-air temperatures of 340 to 755 k (610 deg to 1360 R), reference velocities of 12.4 to 26.1 meters per second (41 to 86 ft/sec), and fuel-air ratios of 0.008 to 0.020. Increasing inlet-air pressure from 4 to 20 atmospheres generally increased smoke number and nitric oxide, but decreased carbon monoxide and unburned hydrocarbon concentrations with air-atomizing and pressure-atomizing nozzles. Emission indexes for carbon monoxide and unburned hydrocarbons were lower at 4, 10, and 20 atmospheres, and nitric oxide emission indexes were lower at 10 and 20 atmospheres with air-atomizing than with pressure-atomizing nozzles. Author

N73-16930*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULTANEOUS FILM AND CONVECTION COOLING OF A PLATE INSERTED IN THE EXHAUST STREAM OF A GAS TURBINE COMBUSTOR
Cecil J. Marek and Albert J. Juhasz Washington Feb. 1973 37 p refs
(NASA-TN-D-7156; E-7165) Avail: NTIS HC $3.00 CSCL 20M

Data were obtained on a parallel-flow film- and convection-cooled test section placed in the exhaust stream of a rectangular-sector combustor. The combustor was operated at atmospheric pressure and at exhaust temperatures of 589 and 1033 K (600 and 1400 F). The cooling air was at ambient pressure and temperature. Test results indicate that it is better to use combined film and convection cooling rather than either film or convection cooling alone for a fixed total coolant flow. An optimum ratio of film to convection cooling flow rates was determined for the particular geometry tested. The experimental results compared well with calculated results. Author

N73-16931*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STUDIES RELATING TO TEMPERATURE CONTROL OF A LARGE SCALE TELESCOPE
S. Katzoff Washington Feb. 1973 63 p refs
(NASA-TN-D-7174; L-8741) Avail: NTIS HC $3.00 CSCL 20M

Analytical methods are developed for estimating the circumfer-

ential and longitudinal temperature distributions in a large space telescope, idealized as a simple insulated tube with a flat mirror across one end. The effects of wall conduction, multilayer insulation, thermal coatings, heat pipes, and heated collars are analyzed, with numerical examples. For most of the study, the only thermal input to the tube was assumed to be from steady solar irradiation from one side, as in a geosynchronous orbit. Unsteady heat flow through the insulation, as in alternating sunlight and shadow of a low orbit, is briefly discussed. Author

N73-16932*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
ASRDI OXYGEN TECHNOLOGY SURVEY. VOLUME 3: HEAT TRANSFER AND FLUID DYNAMICS. ABSTRACTS OF SELECTED TECHNICAL REPORTS AND PUBLICATIONS
A. F. Schmidt, ed. Washington NASA 1972 177 p refs Sponsored by NASA
(NASA-SP-3076-Vol-3) Avail: NTIS HC $3.00 CSCL 20M

Selected information is presented from an assemblage of reports and publications on heat transfer and fluid dynamics with direct applicability to oxygen systems. For each document cited, an abstract has been prepared together with key words and a listing of most important references found in the document. Additionally, an author index, a subject index, and a key word index have been provided to simplify the retrieval of specific information from this work. In each subject area - e.g., boiling heat transfer - the individual citations are listed alphabetically by first author, with review papers dually noted under the appropriate subject category and under review papers. Of the documents reviewed and evaluated for inclusion in this publication, coverage of existing information directly concerned with oxygen-designated but considered applicable to oxygen by the reviewer e.g., a two-phase friction factor correlation derived from nitrogen experiments is occasionally given where no actual oxygen data exist, as an aid to the reader. Approximately 130 abstracts are listed. Author

N73-16933*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYDROGEN AND HYDROCARBON DIFFUSION FLAMES IN A WEIGHTLESS ENVIRONMENT
John B. Haggard, Jr. and Thomas H. Cochran Washington Feb. 1973 30 p refs
(NASA-TN-D-7165; E-6687) Avail: NTIS HC $3.00 CSCL 20M

An experimental investigation was performed on laminar hydrogen-, ethylene-, and propylend-air diffusion burning in a weightless environment. The flames burned on nozzles with radii ranging from 0.051 to 0.186 cm with fuel Reynolds numbers at the nozzle exit from 9 to 410. Steady-state diffusion flames existed in a weightless environment for all the fuels tested. A correlation was obtained for their axial length as a function of Schmidt number, Reynolds numbers, and stoichiometric mole fraction. The maximum flame radii were correlated with the ratio of nozzle radius to average fuel velocity. The flames of ethylene and propylene on nozzles with radii 0.113 or larger appeared to be constantly changing color and/or length throughout the test. No extinguishment was observed for any of the gases tested within the 2.2 seconds of weightlessness. Author

N73-16934*# Kanner (Leo) Associates, Redwood City, Calif.
AERODYNAMICS OF LAMINAR DIFFUSIVE FLAMES
L. P. Yarin Washington NASA Feb. 1973 17 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk), v. 7, Sep. 1971 p 395-404
(Contract NASw-2481)
(NASA-TT-F-14688) Avail: NTIS HC $3.00 CSCL 21B

The Burke-Shumann-Zeldovich flame model (1928, 1949) is used in an analysis of the aerodynamic characteristics of free, semibounded and slipstream types of straight-jet laminar gas flames. Expressions are given to determine the flame length vs Reynolds number, the temperature and fuel concentrations along and across the flame axis, and combustion rates as a function of flame and gas flow parameters. Author

N73-16935# Los Alamos Scientific Lab., N.Mex.
PARAMETER STUDY OF SPALL CALCULATIONS IN ONE-DIMENSIONAL HYDRODYNAMICS CODES
George N. Brotbeck Jul. 1972 5 p refs
(Contract W-7405-eng-36)
(LA-5001) Avail: NTIS

Spall calculations were made using a pressure gradient spall model in the one-dimensional hydrodynamics codes CIRCE, COMBO, RICSHAW, and SIN. The system for which these calculations were carried out consisted of a 10 cm slab of Composition B high explosive adjacent to a 2.54 cm slab of aluminum. The results are presented and it is shown that the calculated spall layers are not sensitive to noise in the rarefaction wave, but that variations in the spall constants can have a significant effect on the quantitative results obtained in the tension region of the aluminum. Author

N73-16936# Atomic Energy Establishment, Winfrith (England).
PRESSURE DROP, HEAT TRANSFER, AND FLOW PHENOMENA FOR FORCED CONVECTION BOILING IN HELICAL COILS: A LITERATURE REVIEW
P. F. Hopwood Jan. 1972 33 p refs
(AEEW-R-757) Avail: AEC Depository Libraries

A review of the literature relevant to forced convection boiling in helical coils is presented, including a discussion of flow phenomena observed in air-water systems. Equations are recommended for the prediction of pressure drop and heat transfer in the econimizer, evaporator and superheater regions of a once-through coil boiler. The possible trajectories of droplets in a coil are discussed, and an extensive bibliography for both single and two-phase flow in coils is presented. Author (NSA)

N73-16937# Naval Postgraduate School, Monterey, Calif.
HEAT TRANSFER AND FLOW FRICTION CHARACTERISTICS OF FIBROUS METALS M.S. Thesis
Richard Harrison Funke Jun. 1972 111 p refs
(AD-751633) Avail: NTIS CSCL 13/1

The single-blow transient testing facility of the Naval Postgraduate School was reconstructed. With this apparatus the flow friction and heat transfer characteristics of four grades of steel wool, considered to be representative of fibrous metals, were determined. The flow friction characteristics were determined on the basis of the isothermal pressure drop across the medium, while the heat transfer results were determined by means of the single-blow transient testing technique. The heat transfer results are presented as the Colburn j-factor. The flow friction results are presented in two forms: as the Fanning friction factor, f; and as the correlating friction factor, Cf. All results are presented as a function of Reynolds number based on the product of the experimentally determined permeability and tortuosity parameter of each sample. Author (GRA)

N73-16938# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE FIELD OF HEAT AND MASS EXCHANGE DURING VAPORIZATION OF A LIQUID INTO A COUNTERFLOW OF GAS
A. A. Dolinskii and G. P. Prikhodchenko 27 Oct. 1972 11 p refs Transl. into ENGLISH from the mono. "Shestaya Mezhvuzovskaya Konferentsiya po Voprosam Isparenlya, Goreniya i Gazovai Dinamiki Dispersnykh Sistem" Odessa, 1968 p 181-185
(AD-751503; FTD-MT-24-1483-72) Avail: NTIS CSCL 20/13

Heat and mass transfer studies between spray atomized (at pressures 2 to 15 bars) liquids and air flowing in the opposite direction at 2 to 15 m/s yielded an average molecular coefficient of heat transfer between the liquid droplets and the air given as Re(L) = L(f)v(0)/v(g), where Re equals Reynolds number, L(f) equals length of atomized liquid envelope, v(0) equals velocity of liquid droplet leaving the nozzle, and v(g) equals kinematic gas viscosity. An equation was developed for calculating L(f). In the recirculation spray drying of solids the L(f) depends to a large extent on the liquid rate. Author (GRA)

N73-16939# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
AN ASYMPTOTIC ANALYSIS OF RADIANT AND HYPERGOLIC HETEROGENEOUS IGNITION OF SOLID PROPELLANTS Final Scientific Report
Amable Linan and Antonio Crespo Jun. 1972 42 p refs
(Contract F61052-69-C-0036; AF Proj. 9711)

(AD-751303; AFOSR-72-2031TR) Avail: NTIS CSCL 21/9

An asymptotic analysis, in the limit of large activation energies, is presented for the ignition of a solid propellant undergoing an exothermic heterogeneous Arrhenius reaction with a gaseous oxidizer. The analysis is carried out for hypergolic or shock tube ignition conditions, and also for ignition under a radiant flux with in-depth absorption of the radiation. The asymptotic analysis illustrates how, for sufficiently large radiant fluxes, a short reaction stage, ending in thermal runaway, follows a much longer inert heating stage. A closed form expression is found to relate the ignition time to the radiant flux and physio-chemical propellant characteristics. An analytical expression is also found for the ignition time under hypergolic or shock tube ignition conditions. Author (GRA)

N73-16940# Stanford Research Inst., Menlo Park, Calif.
A CHEMICAL KINETICS MODEL FOR THE OPPOSED FLOW DIFFUSION FLAME
C. M. Ablow and H. Wise 15 Oct. 1972 37 p refs
(Contract N00014-70-C-0155; NR Proj. 092-507)
(AD-751053; SRI-PYU-8378) Avail: NTIS CSCL 21/2

A theoretical analysis is developed of the reaction kinetics limitations leading to the extinction of a counterflow diffusion flame. With increasing mass flux of reactants into the diffusion flame a maximum in the consumption rate of fuel and oxidizer in the reaction zone is encountered. The analysis shows that experimental measurements of the extinction conditions (apparent flame strengths) are amenable to evaluation of overall kinetic parameters such as the activation energy, the preexponential Arrhenius term, and the order of reaction. The theoretical model is applied to the propane-oxygen-nitrogen system and an activation energy of 21.9 kcal/mole is derived from published experimental flame extinction data. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-16941*# Denver Research Inst., Colo. Industrial Economics Div.
PROGRAM FOR TRANSFER RESEARCH AND IMPACT STUDIES Semiannual Report, 1 Jan. - 30 Jun. 1972
James P. Kottenstelle, Jerome J. Rusnak, and Eileen R. Staskin
Nov. 1972 101 p
(Contract NASw-2362)
(NASA-CR-130302) Avail: NTIS $7.25 CSCL 05B

The progress made in achieving TRIS research objectives during the first six months of 1972 is reviewed. The Tech Brief-Technical Support Package Program and technology transfer profiles are presented along with summaries of technology transfer in nondestructive testing, and visual display systems. F.O.S.

N73-16942# Battelle Inst., Frankfurt am Main (West Germany).
[SCIENTIFIC RESEARCH REPORTS] Information 14
Nov. 1972 76 p
Avail: NTIS HC $6.00

The activities of the Battelle Institute are reported. The works presented include: estimates of expenditures on environmental protection, experimental verification and assessment of infrared radiation modulator, information processing in visual systems, and membranes for reverse osmosis. Reports, publications, and lectures in biosciences, chemistry, mechanical engineering, physics, materials sciences, and economics are included. A review of the conference on chemical vapor deposition and its industrial applications is also presented. F.O.S.

N73-16943# Aeronautical Research Labs., Melbourne (Australia).
[AERONAUTICAL RESEARCH AND DEVELOPMENT] Annual Report, 1971 - 1972
1972 90 p refs Original contains color illustrations
Avail: NTIS HC $6.50

Aeronautical research is reported for 1971-1972. Work in the following areas is discussed: aircraft materials, defect detection, aircraft structures, aerodynamic, propulsion, high temperature, turbine blades, human factors, instrumentation, testing, damage assessment, and life of aircraft engines.

F. O. S.

N73-16944*# Texas Univ., Austin. Bureau of Business Research.
A CONTRIBUTION TO THE DEVELOPMENT OF AN ECONOMIC ATLAS OF THE HOUSTON AREA TEST SITE
31 Dec. 1972 277 p
(Contract NAS9-12949)
(NASA-CR-128719) Avail: NTIS HC $16.00 CSCL 05C

An outine description of the Houston Area Test Site was prepared, in the form of an atlas-catalog of Universal Transverse Mercator grid coordinate locations, building on the manufacturing sector and expanding along agreed lines as far as possible. It was concluded that (1) the effort expended in securing and verifying the locations of larger manufacturing plants yielded 5,000-plus usable entries, in addition to certain valuable conclusions about the general feasibility of obtaining ground information by economic sector; (2) on the basis of the number and the quality of the usable entries obtained, the resources expended on nonmanufacturing sectors and on historical data cannot be wholly justified; and (3) even without the 5,000-odd locations of completely satisfactory quality, the relatively modest cost of this pilot study secured enough data to provide a sound basis for obtaining feasibly and systematically some appropriate ground information on almost any economic or social activity, together with some indication of their relative areal and economic significance. Author

N73-16945# National Science Foundation, Washington, D.C.
NATIONAL SCIENCE FOUNDATION GUIDE TO PROGRAMS, FISCAL YEAR 1973
1973 93 p refs
(NSF-72-23) Avail: SOD HC $1.50

Information on the areas of research, eligibility, and deadlines are presented for each grant program. The NSF continues to emphasize basic research, particularly in academic institutions, and the improvement of science education, but also encourages participation by industries and other nonacademic organizations. The general areas of interest are scientific research project support, national and special research applications, national research centers, international cooperative scientific activities, science education, computing activities, and special programs. N.E.N.

N73-16946# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 294
10 Jan. 1973 20 p Transl. into ENGLISH from Eastern Europe reports
(JPRS-57952) Avail: NTIS HC $3.00

Articles concerning the development of and progress in the various theoretical and applied scientific disciplines and technical fields; and the administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences are presented. Specific subjects concern: (1) functions of a biology center, (2) prostaglandin research, (3) development of MKJ-25 computer, (4) activities of physics institute, and (5) exploitation of uranium deposit. Author

N73-16947*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
POTENTIAL BENEFITS OF REMOTE SENSING: THEORETICAL FRAMEWORK AND EMPIRICAL ESTIMATE
Ludwig M. Eisgruber [1972] 17 p refs
(Grant NGL-15-005-112)
(NASA-CR-130027; Inform-Note-030872) Avail: NTIS HC $3.00 CSCL 05C

A theoretical framwork is outlined for estimating social returns from research and application of remote sensing. The approximate dollar magnitude is given of a particular application of remote sensing, namely estimates of corn production, soybeans, and wheat. Finally, some comments are made on the limitations of this procedure and on the implications of results. Author

N73-16948# Delaware Bay Oil Transport Committee, Dover.
ENERGY, OIL, AND THE STATE OF DELAWARE. A PROPOSAL FOR SAFEGUARDING THE DELAWARE ESTUARY AND COASTLINE BY SAFER TRANSPORT OF OIL
15 Jan. 1973 61 p refs
Avail: NTIS HC $5.25

The pollution hazards of petroleum industries and shipping in the Delaware Bay are considered. Petroleum refineries on the Dalaware River, Delaware River traffic, lightering operations in the lower bay, cleanup responsibility of spilled oil, oil imports, and world crude oil transportation are discussed along with alternative petroleum transport systems. Recommendations for the increased protection from spills are included. F.O.S.

N73-16949# Committee on Science and Astronautics (U. S. House).
FEASIBILITY STUDY OF AN AEROSPACE MUSEUM IN THE WESTERN UNITED STATES, VOLUME 1-5
31 Jul. 1972 612 p refs Presented to Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 31 Jul. 1972 Prepared by Smithsonian Institution
Avail: Comm. on Sci. and Astronaut.

Documentation and conclusions of the feasibility study are presented. The documents include supporting papers, investigative reports, surveys, and studies on costs and methodologies. Among the conclusions are the following: (1) Prime consideration should be given to the development of aerospace exhibits of existing museums rather than the establishment of a new major museum. (2) Should Federal funds be requested for a single major aerospace museum in the Western United States, the California Museum of Science and Industry proposal should be given first consideration. (3) Even if the dirigible hangar at Moffett Field Naval Air Station could be made available, its location and cost of conversion would not recommend it. (4) The expansion of the Smithsonian Institution Traveling Exhibit Service activities may be beneficial. N.E.N.

N73-16950# Istituto Universitario Navale, Naples (Italy). Ist. di Meteorologia e Oceanografia.
[SELECTED PAPERS ON OCEANOGRAPHY, METEOROLOGY, GEOPHYSICS, AND ATMOSPHERICS CARRIED OUT BY MEMBERS OF THE INSTITUTE OF METEOROLOGY AND OCEANOGRAPHY IN HONOR OF PROF. GIUSEPPIA ALIVERTI]
Jun. 1972 301 p refs Partly in ENGLISH; partly in FRENCH; and partly in ITALIAN
Avail: NTIS HC $17.25

Selected studies in the field of oceanography, geology, geophysics, vulcanology, navigation, solar physics, and hydrometeorology are described. For individual titles, see N73-16951 through N73-16973. ESRO

N73-16951 Tokyo Univ. (Japan). Ocean Research Inst.
PROBLEM OF TIDAL CURRENT ELLIPSES c13
Koji Hidaka *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 9-13 refs (For availability see N73-16950 07-34)

The causes of tidal current rotation are investigated. The problem is treated as a free wave propagation problem where the waves, assimilated with Poincare waves, propagate in a rotating rectangular straight canal of uniform depth and breadth. It is proved that the rotary currents are due to the earth's rotation. ESRO

N73-16952 National Museum of Natural History, Paris (France).
SELF OSCILLATIONS IN A VARIABLE DEPTH ROTATING BASIN. SECOND CLASS MODES [OSCILLATIONS PROPRES DANS UN BASSIN TOURNANT DE PROFONDEUR VARIABLE. MODES DE SECONDE CLASSE] c12
B. Saint-Guily *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 15-25 refs In FRENCH (For availability see N73-16950 07-34)

The existence of second class waves in a basin is due to the Coriolis parameter variation with the latitude and to the sea bottom relief. The case of a circular basin with parabolic bottom is treated as well as that of a circular basin with a quartic bottom and a circular island bounded by a parabolic slope. The free oscillations of a liquid in a rotating basin were investigated for these three cases. The same properties were found for the second class models. The periods are superior to the periods of inertia and approach a limit period series by superior values in the closed basin case and by inferior values in the island case. ESRO

N73-16953 Academy of Sciences (USSR), Moscow. Inst. of Oceanology.
ON THE SUMMER DAILY HEATING AND DIURNAL HEAT BUDGET OF THE UPPER OCEAN LAYER c13
K. N. Fedorov *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 27-40 refs (For availability see N73-16950 07-34)

A three-day series of temperature recordings obtained in July-August 1970 with an in situ digital salinity-temperature-depth recorder in the upper 50 m layer of the tropical Atlantic is analyzed with a view to studying the diurnal heat wave in the ocean. Measurements were made every odd hour and were supplemented by ordinary Nansen bottle casts made every even hour. Values of the actual heat intake by the upper ocean layer are compared with those calculated from the heat balance equation. The average daily heat budget is calculated. Author (ESRO)

N73-16954 Naval Undersea Center, San Diego, Calif.
ROUGHNESS OF THE THERMOCLINE c13
K. G. LaFond and E. C. LaFond *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 41-54 refs (For availability see N73-16950 07-34)

The roughness of the isotherms in the thermocline, within the ranges of 0.10 to 10.0 miles can be expressed by the distribution of slope, wavelength, wave height, autocorrelation variance, and power spectra. The nature of the slope of the log-log function of the power spectra provides an indication of turbulence. Values for these functions have been determined from continuous isotherm data collected in and near the California Front in the northeast Pacific Ocean. Author (ESRO)

N73-16955 Environmental Prediction Research Facility (Navy), Monterey, Calif.
NUMERICAL ANALYSIS OF OCEAN SURFACE CURRENTS c13
S. Larson and T. Laevastu *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 55-74 refs (For availability see N73-16950 07-34)

Continuing development at Fleet Numerical Weather Central (FNWC) of a suitable large-scale method of analysis and prediction of surface current (mean current between the surface and top of the thermocline) in the Northern Hemisphere with grid size from 20 to 380 km and with a 12-hourly time step. The total current flow is assumed to be a sum of permanent thermohaline flow and local wind-driven flow, including mass transport by waves. The rationale of this approach is presented, results described and examples of the analysis output are shown. Author (ESRO)

N73-16956 Institute of Oceanology, Gelendjik (USSR).
ON THE INFLUENCE OF A BOTTOM TOPOGRAPHY AND THE EARTH'S ROTATION ON THE WIND-DRIVEN CIRCULATION IN THE MEDITERRANEAN SEA c13
L. M. Fomin and L. V. Moskalenko *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 75-90 refs (For availability see N73-16950 07-34)

The influence of wind field nonuniformity, bottom topography, and water stratification on formation of a wind-driven circulation in the eastern part of the Mediterranean Sea is analyzed on the basis of numerical solution of the vertical integrated equation. It is shown that the bottom relief modifies the picture of water circulation. Particularly the relief can intensify streams along boundaries as well as Stommel's westward intensification of currents. The numerical calculations demonstrate the wind nature of main steady state currents in the Mediterranean Sea. Transportation of the atlantic water along all the western part of the sea seems to be the effect of lateral diffusion between separate circulation gyres strengthened slightly by thermohalinic currents. Author (ESRO)

N73-16957 Woods Hole Oceanographic Institution, Mass.
TEMPERATURE-SALINITY REGIME IN A NORTH-SOUTH SECTION OF THE TYRRHENIAN SEA c13
Arthur R. Miller *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 91-100 refs (For availability see N73-16950 07-34)
(Contrib-2725)

Some comparisons are made among temperature salinity observations obtained during the International Geophysical Year (1957-1958) and observations from the research vessel Atlantis (cruise 275) in 1962. The temperature-salinity regime, as described, is confined to a north-south section of the Tyrrhenian Sea with the track of the vessel Atlantis as a base. Thorough coverage of the Italian IGY vessels permitted a reconstruction of temperature-salinity profiles through that base track using the Tyrrhenian Sea atlas as a guide for both position and distribution. Author (ESRO)

N73-16958 Istituto Universitario Navale, Naples (Italy).
HYDROLOGY OF THE SICILIAN CHANNEL. S.S. DECTRA, OCTOBER 1969 [IDROLOGIA DEL CANALE DI SICILIA. NAVE DECTRA, OTTOBRE 1969] c13
A. DeMaio, M. Moretti, E. Sansone, and D. Bregant (Ist. Sper. Talassografico) *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 101-137 refs In ITALIAN (For availability see N73-16950 07-34)

The program for the observation of water currents from ships is outlined. It includes physicochemical measurements in areas of particular interest. Data on salinity, temperature, and oxygen concentration recorded on board the Dectra from 8 to 24 October 1969 in the Sicilian Channel and correlated with data obtained from 63 other sea stations are presented. ESRO

N73-16959 Istituto Universitario Navale, Naples (Italy).
MEASUREMENTS OF SOUND WAVE ATTENUATION IN THE TYRRHENIAN SEA [MISURE DI ATTENUAZIONE DI IMPULSI SONORI NEL MARE TIRRENO] c23
E. Paolini *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 139-156 In ITALIAN Sponsored by CNR (For availability see N73-16950 07-34)

The causes of sound wave attenuation in the sea were investigated. Equipment for measuring sound transmission in sea water is described. It includes a sound signal generator located aboard the motorboat Lokan, a receiver located aboard Dectra, and a piezoelectric hydrophone immersed at different depths. The principles of the method for measuring sound attenuation are explained, and results obtained are discussed. ESRO

N73-16960 Institute of Marine Research, Helsinki (Finland).
THE COMPLEXITY OF THE PROBLEM OF MEAN SEA LEVEL c13
Eugenie Lisitzin *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 157-162 refs (For availability see N73-16950 07-34)

A short survey of the deviating points of view presented by different oceanographers on the classification of the causes for sea level variations is given. The complexity of the problem of determining the mean sea level is stressed and it is suggested that by dividing the ocean into regions according to depth the mean sea level can be found. ESRO

N73-16961 Osservatorio Geofisico Sperimentale, Trieste (Italy).
THE ADRIATIC SEA: CALCULATION OF NEW HARMONIC CONSTANTS FOR SOME HARBORS [LE MAREE DELL' ADRIATICO: CALCOLI DI NUOVE COSTANTI ARMONICHE PER ALCUNI PORTI] c13
F. Mosetti and B. Manca *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 163-177 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

New harmonic constants of the water wave component in some Adriatic Sea harbors are presented. The components were separated from the tide records using the filtering method and selecting the large amplitude components. Taking into account spurious effects perturbing each astronomical tide, the constants were adjusted. The original harmonic constants obtained by filtering technique are reported. The original and compensated constants for some components are tabulated and compared. It is concluded that each component is characterized by a wave form: $y(t) = Aj \cos(\text{omega } j\ t + \text{phi } j)$ where omega j is an astronomical datum, A j and phi j are calculated from filtered results obtained of the least squares method, and phi j is referred for each component to the t = 0 hour of 1st January 1968. Author (ESRO)

N73-16962 Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
INFLUENCE OF CHEMICAL MEDIATORS ON THE OCEANIC INTER-SPECIES RELATIONSHIPS [INFLUENCE DES MEDIATEURS CHIMIQUES SUR LES RELATIONS INTER-ESPECES OCEANIQUES] c13
M. Aubert *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 179-184 refs In FRENCH (For availability see N73-16950 07-34)

The influence of chemical mediators on the antibiotic activity of phytoplankton was investigated by studying the ultraviolet absorption spectra in the 265 mm of a diatomaceous earth, Astreniolla japonica, and a Peridinian, Protocentrum micans, in a sea water culture. It is concluded that some biological species (Protocentrum micans) in the sea water are able to inhibit at a distance the synthesis of chemical compounds of other species (diatomaceous earth) which have antibacterial action. ESRO

N73-16963 Istituto Universitario Navale, Naples (Italy).
THE MEAN TEMPERATURE OF THE STANDARD ATMOSPHERE AND ALTIMETRIC CORRECTIONS [TEMPERATURA MEDIA DELL'ARIA TIPO E CORREZIONI ALTIMETRICHE] c13
Guiseppe Simeon *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 185-193 In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

A relation is established that gives the mean temperature of the standard atmosphere, taking into account the altimetric corrections. ESRO

N73-16964 State Univ. of New York, Albany. Atmospheric Sciences Research Center.
REMARKS ON THE USE OF CONDENSATION NUCLEI MEASUREMENTS c20
J. Podzimek *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 195-212 refs (For availability see N73-16950 07-34)

The current stage of development in the field of condensation nuclei measurement is surveyed and general conclusions for the application discussed. An interpretation of the results of experiments and of papers published in the field is presented. ESRO

N73-16965 Genoa Univ. (Italy). Inst. for Geophysics and Geodesy.
SOLAR FLARE CONTROL OF THUNDERSTORM ACTIVITY c20
M. Bossolasco, I. Dagnino, A. Elena, and G. Flocchini *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 213-218 refs (For availability see N73-16950 07-34)

Results showing the evident influence of chromospheric flares on global thunderstorm activity are presented. Using data gathered over the Mediterranean region during 1961-1970, it was found that thunderstorm activity became maximum on the third and fourth day after the flare. ESRO

N73-16966 Istituto Universitario Navale, Naples (Italy). Ist. di Meteorologia e Oceanografia.
THE CARBON DIOXIDE CONCENTRATION IN VARIOUS ITALIAN AND SCANDINAVIAN CITIES [IL CO2 IN ALCUNE LOCALITA ITALIANE E SCANDINAVE] c13
A. DeMaio, W. Bischof (Inst. of Meteorol., Stockholm), M. Moretti, and E. Sansone *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 219-234 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

Carbon dioxide concentration was measured in air samples collected from the sea level up to 5000 m in the Golfo di

Salerno and over various Scandinavian areas (Stockholm, Maelaren Lake, Toereboda, Copenhagen). The mean annual variations of the CO2 contents at various heights, and the vertical distribution of the mean square deviations of the measurements are presented and compared for the different locations. A 2.9 ppm higher CO2 content was found in Naples than in Stockholm, while in Toereboda the carbon dioxide was found to be absorbed. ESRO

N73-16967 Politecnico di Torino (Italy). Ist. di fisica Sperimentale.
THE QUASI-PERIODIC 6-DAY VARIATION IN COSMIC RAY INTENSITY [SULLA VARIAZIONE QUASI-PERIODICA DI CIRCA SEI GIORNI NELL'INTENSITA DELLA RADIAZIONE COSMICA] c29
Giuseppe Lovera *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 235-242 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

The presence of a quasi-periodic variation of about six days in cosmic ray intensity was investigated using the Vercelli method applied to the processing of data recorded from Cheltenham, Huancayo, and Christchurch astronomical observatories for six half-year intervals between 1938 and 1954. The values of average amplitudes, periods, and correlation coefficients are given and discussed with reference to the 27 day and 13 day recurring variations. ESRO

N73-16968 Consiglio Nazionale delle Ricerche, Milan (Italy). Lab. per la Geofisica della Litosfera.
MEASUREMENT OF THE THERMAL INFRARED FIELD: FIRST APPLICATIONS TO GEOPHYSICS IN ITALY [LE MISURE NEL CAMPO DELL'INFRAROSSO TERMICO: PRIME APPLICAZIONI ALLE SCIENZE DELLA TERRA IN ITALIA] c13
R. Cassinis, G. M. Lechi, and A. M. Tonelli *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 243-252 In ITALIAN (For availability see N73-16950 07-34)

The theoretical principles of infrared spectroscopy and the interest of this technique applied to remote sensing of earth resources are outlined. The equipment, which includes radiometers and scanners, is described. Data recorded from 6 to 16 April 1970 using an infrared scanner in the 8 to 14 micron range to study the Solfarata di Pozzuoli area are presented. Results obtained from data on voulcanology of the Eolean Islands recorded during May 1970 and data on radiance anomalies recorded during remote sensing of Solfarata di Pozzuoli are also given. ESRO

N73-16969 Politecnico di Torino (Italy). Ist. di Fisica Generale.
POSITRON ANNIHILATION IN WATER AND ICE [L'ANNICHILAZIONE DEL POSITRONIO IN ACQUA E GHIACCIO] c24
P. Colombino *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 253-259 refs In ITALIAN (For availability see N73-16950 07-34)

The technique of angular correlation measurement of annihilation radiation in two photons is described. This technique was used to study positron annihilation in water and ice at various temperatures, the thermalization level, and the relationship between positron quantity and the physical properties of the substance (phase transformations etc.). ESRO

N73-16970 Istituto Universitario Navale, Naples (Italy).
CYCLOIDS OF CONSTANT AZIMUTH [CICLOIDI DI EGUALE AZIMUT] c30
Antonino Sposito *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 261-267 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

A particular trajectory on the surface of the rotating, spherical earth for which the azimuth of a star is constant is analyzed. The case of a 90 deg azimuth is examined and its representation on navigational charts discussed. ESRO

N73-16971 Istituto Universitario Navale, Naples (Italy).
THEORETICAL FORMULATION OF A CELESTIAL NAVIGATION METHOD [IMPOSTAZIONE TEORICA DI UN METODO DI NAVIGAZIONE ASTRONOMICA] c30
Giancarlo Lucarelli *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 269-277 In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

The possibilities offered by the use of astronomical refraction, particularly solar and lunar image deformation, for navigation are considered. Applications to inertial navigation are discussed with emphasis on daytime control when only the sun can be observed. ESRO

N73-16972 Istituto Universitario Navale, Naples (Italy).
THE MOST PROBABLE POSITION IN THE ASTRONOMICAL NAVIGATION WITH FICTITIOUS CELESTIAL BODIES [PUNTO PIU PROBABILE IN NAVIGAZIONE ASTRONOMICA CON ASTRI FITTIZI] c30
Aniello Russo *In* Ist. Univ. Navale Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 279-286 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

A method is described for calculation of the most probable observer's position by measuring celestial body altitude. This procedure consists of measurement of two imaginary celestial body coordinates. The position is defined from the intersection of the celestial body altitude circumference planes with the sphere on which the observer is placed. The calculation was done by a computer. ESRO

N73-16973 Istituto Universitario Navale, Naples (Italy).
AN APPLICATION OF KALMAN FILTERING TO THE ASTRONOMICAL POSITION DETERMINATION BY ALTITUDE MEASUREMENT [UN'APPLICAZIONE DEL FILTRO DI KALMAN ALLA DETERMINAZIONE ASTRONOMICA DELLA POSIZIONE CON RETTE D'ALTEZZA] c30
Vincenzo Nastro *In its* Selected Papers on Oceanog., Meteorol., Geophys., and Atmospherics Jun. 1972 p 287-293 refs In ITALIAN; ENGLISH summary (For availability see N73-16950 07-34)

The principles of the optimal Kalman filtering technique are reviewed and applied to air navigation. The method used consists of position determination using celestial body altitude measurements. Results obtained using this technique are discussed. ESRO

N73-16974# Department of Atomic Energy, Bombay (India).
[ATOMIC ENERGY AND SPACE RESEARCH IN INDIA] Annual Report, 1971 - 1972
1972 192 p
(NP-19407) Avail: AEC Depository Libraries

Research in India is reported for 1971 and 1972. Developments in the following areas are included: agriculture, biology, chemistry, desalting, and reactor fuels. F.O.S.

N73-16975# Brussels Univ. (Belgium). Inst. de Mecanique Appliquee.
ACTIVITIES OF THE INSTITUTE OF APPLIED MECHANICS, 1957-1972 [QUINZE ANS D'ACTIVITE DE L'INSTITUT DE MECANIQUE APPLIQUEE DE L'UNIVERSITE LIBRE DE BRUXELLES, 1957-1972]
1972 36 p refs In FRENCH
(NT-32-1972) Avail: NTIS HC $4.00

The activities of the Institute of Applied Mechanics in the fields of air cushion vehicles, flexible cascades, pipes, turbomachinery, MHD flow, plasma generators, fluidics, thermodynamics, etc. are reported for the period 1957 to 1972. ESRO

N73-16976# Faucett (Jack) Associates, Inc., Chevy Chase, Md.
CAPITAL STOCK MEASURES FOR TRANSPORTATION, VOLUME 1 Final Report
Raymond C. Scheppach and Jack G. Faucett Jun. 1972 133 p refs
(Contract DOT-OS-10195)
(PB-212307; JACKFAU-71-04-1) Avail: NTIS HC $3.00 CSCL 13B

Capital stock measures for some twenty transportation modes for the period 1950-1970 are presented. The major commercial and non-commercial modes are included, and the large amount of public capital in highways, waterways, airports and airways has been estimated and allocated to the using modes. The estimates are presented in both historical and constant 1958

collars. A methodology to derive the cost of capital, and some comparisons of the capital intensity of transportation relative to other sectors of the economy are included. Author (GRA)

N73-16977# Faucett (Jack) Associates, Inc., Chevy Chase, Md.
CAPITAL STOCK MEASURES FOR TRANSPORTATION. VOLUME 2: STATISTICAL SUPPLEMENT Final Report
Raymond C. Scheppach and Jack G. Faucett Jul. 1972 170 p (Contract DOT-OS-10195)
(PB-212308; JACKFAU-71-04-2) Avail: NTIS HC $3.00 CSCL 13B

The statistical supplement to a capital stock analysis of transportation modes is divided into four sections. The first section presents the investment and capital stock series, both net and gross, in historical and constant dollars for reproducible capital. Stock estimates for nonreproducible capital, such as land, are presented in the second section. The third section gives inventory measures for the major types of revenue equipment, and the last section presents estimates of the average age of certain types of revenue equipment. GRA

N73-16978# Parsons-Brinckerhoff-Tudor-Bechtel, San Francisco, Calif.
SAN FRANCISCO AIRPORT ACCESS PROJECT
May 1972 40 p Prepared in cooperation with Smith (Wilbur) and Associates, San Francisco, Calif. and Kirker, Chapman Consultants, San Francisco, Calif.
(Contract DOT-UT-262)
(PB-212456; UMTA-CA-09-0012-72-1) Avail: NTIS HC $3.00 CSCL 13B

An earlier study of the feasibility of extending the Bay Area Rapid Transit (BART) system to serve San Francisco International Airport is summarized. This summary was prepared to answer several basic questions about the proposed BART extensions: (1) how can such transit help? (2) how soon is it needed? (3) what will it be like? (4) how might the cost be shared? (5) will it be built? A proposed route description and various financing alternatives are discussed. GRA

N73-16979# National League of Cities, Washington, D.C.
SCIENCE AND TECHNOLOGY FOR THE CITIES Final Report
John Feild Jul. 1972 120 p refs
(Grant NSF GT-28)
(PB-212762) Avail: NTIS HC $3.00 CSCL 05I

The potential for utilization of scientific and technical personnel by local governments is considered. Five major areas are covered: (1) Local goverment's ability to re-employ former aerospace and defense professionals; (2) local research and development programs that could be expanded or supplemented; (3) the market for local government research and development based on five year projections of expenditures and needs; (4) improving relationships local governments have with consulting engineers and equipment manufacturers that would enhance the use of new scientific and technical discoveries; and (5) relationships among Federal, state and local governments in the areas of science policy and services. GRA

N73-16980# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 25, NO. 10
John M. Leonard and Victoria Hewitson 31 Oct. 1972 30 p refs
(AD-751630) Avail: NTIS CSCL 05/2

The monthly publication presents brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by disclosing interesting information well in advance of the usual scientific publications. Author (GRA)

N73-16042 Joint Publications Research Service, Arlington, Va.
FIFTIETH ANNIVERSARY OF FORMATION OF THE UNION OF SOVIET SOCIALIST REPUBLICS
A. N. Babiychuk *In its* Space Biol. and Med., vol. 6, no. 6, 1972 18 Jan. 1973 p 1-6 (For availability see N73-16041 07-04)

N73-16393* Iowa Univ., Iowa City. Inst. of Urban and Regional Research.
THE APPLICATION OF REMOTE SENSING TECHNIQUES TO URBAN DATA ACQUISITION
Frank E. Horton *In* NASA, Washington Intern. Workshop on Earth Resources Surv. Systems, Vol. 2 1971 p 212-223 refs (For availability see N73-16382 07-13)
CSCL 05K

N73-16395* Geological Survey, Washington, D.C.
CENSUS CITIES PROJECT AND ATLAS OF URBAN AND REGIONAL CHANGE
James R. Wray *In* NASA, Washington Intern. Worskhop on Earth Resources Surv. Systems, Vol. 2 1971 p 242-259 (For availability see N73-16382 07-13)
CSCL 05K

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